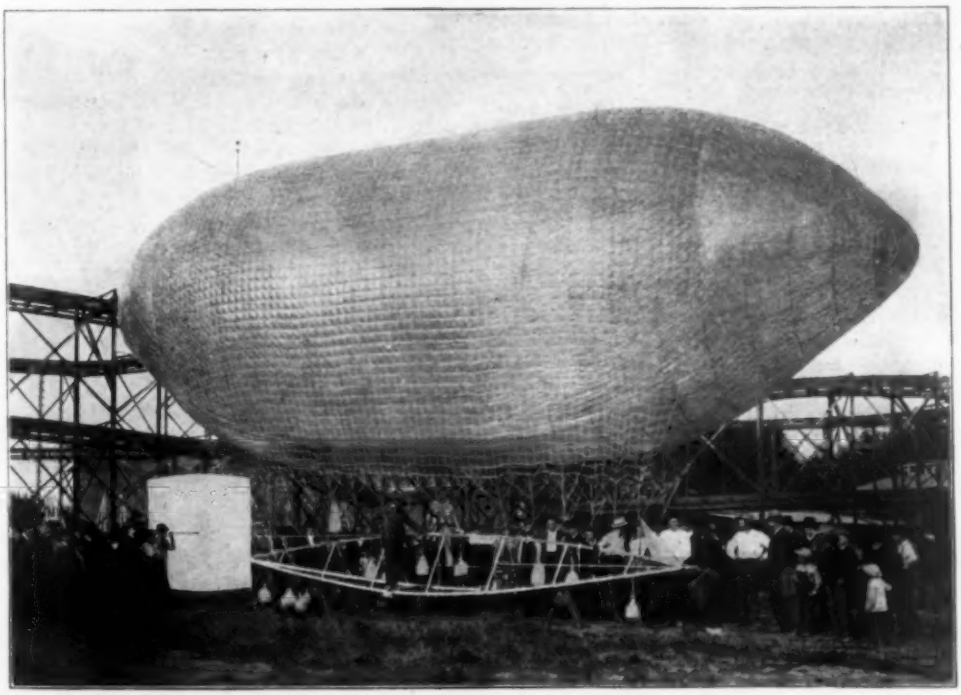
POPULAR MECHANICS

Vol. 6. No. 10. CHICAGO, OCTOBER, 1904. 10 Cents a copy. $1.00 a year.

Californian's New Airship Successful

Airship building is receiving a great deal of attention from California inventors and some have made notable achievements in this line. Capt. T. S. Baldwin, of Oakland, has invented a new airship with which he has made several successful trips. The first trial was made at Idora Park in Oakland and since then the ascensions have drawn vast crowds of spectators.



A Successful New Airship to be Entered at St. Louis

In these trials no high altitudes were reached, or sought to be attained. The inventor's principal purpose was to determine if the movements of his ship could be controlled. This very important feat he found could be readily accomplished.

At a height of over 600 feet the aeronaut made a number of wide circles going around the large park. He went both against and with the wind; also moving at various angles to the breeze and each time brought his ship back to the starting point, and came down safely. The vessel was found to obey her helm nicely.

These various tests clearly demonstrated that in every revolution of the propeller, and in every move of the steering gear, and

adjustment of the weights which raise or lower the ship at will, the plans of the inventor had been carried out.

Captain Baldwin's airship differs in several important features from other aerial machines. The chief of these is that the large propeller, having two metallic blades and nearly 6 feet in diameter, instead of being placed at the stern, is located at the bow of the frame, or car. In this manner the airship, instead of being driven forward, is pulled through the atmosphere. The inventor claims that this action allows of much greater speed; also that it greatly facilitates the steering, as well as lowering or raising the ship.

The dirigible part, or balloon, is of a blunt, cigar shape, measuring 54 feet long, and 17 feet in diameter in the middle. The balloon is of fine, strong and flexible silk, and with the netting by which it is attached to the car, weighs only 90 pounds. It is inflated with hydrogen gas, and, at ordinary distension, contains 8,000 cubic feet. Some 12 feet below is suspended the frame that supports the propelling and steering mechanism. This frame is constructed of strong light wood in triangular shape, the three ends uniting at a common center at each extreme. The frame is 48 feet long, and is very securely lashed and braced. It has been thoroughly tested, and will support 1,400 pounds with safety.

The engine that drives the propeller is one of the ordinary gasoline type, furnishes seven horsepower, and weighs only 60 pounds. The transmitting mechanism is so adjusted and geared as to drive the propeller at the speed of 150 revolutions per minute. With this power a good speed may be attained under ordinary conditions.

The car weighs 65 pounds. Total weight of the airship is 220 pounds, while its buoyancy will raise nearly 500 pounds.

The rudder, which is rectangular, about 5 by 3½ feet, is worked from any part of the car and the engine is regulated by a steel lever. One person can navigate the airship. The aeronaut can sit about midway of the frame, or he may move about freely without disturbing the general balance. The propeller may be reversed at pleasure, and the vessel pushed backward, if necessary or desirable.

Captain Baldwin intends soon to construct another that will be six feet longer, and weigh 15 pounds less than the present one. This he thinks will add to and facilitate the speed.

WORK OF LOCOMOTIVES DEPENDS ON THEIR FIREMEN.

The large freight locomotives of today are twice as powerful as the engines of a few years ago. This means they must burn twice as much coal to make the twice as much steam required to pull the twice as long trains. In order to get a grate big enough to hold the increased mass of fire the fireboxes have been made longer and wider. This greatly increases the difficulty of firing and requires not only more physical exertion to perform the increased work, but considerably greater skill to do it properly.

At the recent annual convention of railroad master mechanics, who are the men in charge of the repair work on the railways of the country, it was agreed that the modern iron monsters have many disadvantages. The track and bridge engineers have long been in despair over the rapidly growing strains to tracks and bridges imposed by these 120-ton plunging weights, and now the shop men complain the repairs are greater and more frequent and out of proportion to the smaller locomotives.

One expert said: "That the care with which wide fireboxes should be fired is not generally appreciated by the men is, we believe, largely the cause of the numerous troubles due to leaking which are experienced with this type of engine. It is more difficult to maintain an even fire on a large grate than on a small one, and as there is a greater tendency to irregular temperature in the former, it is the direct cause of leakage."

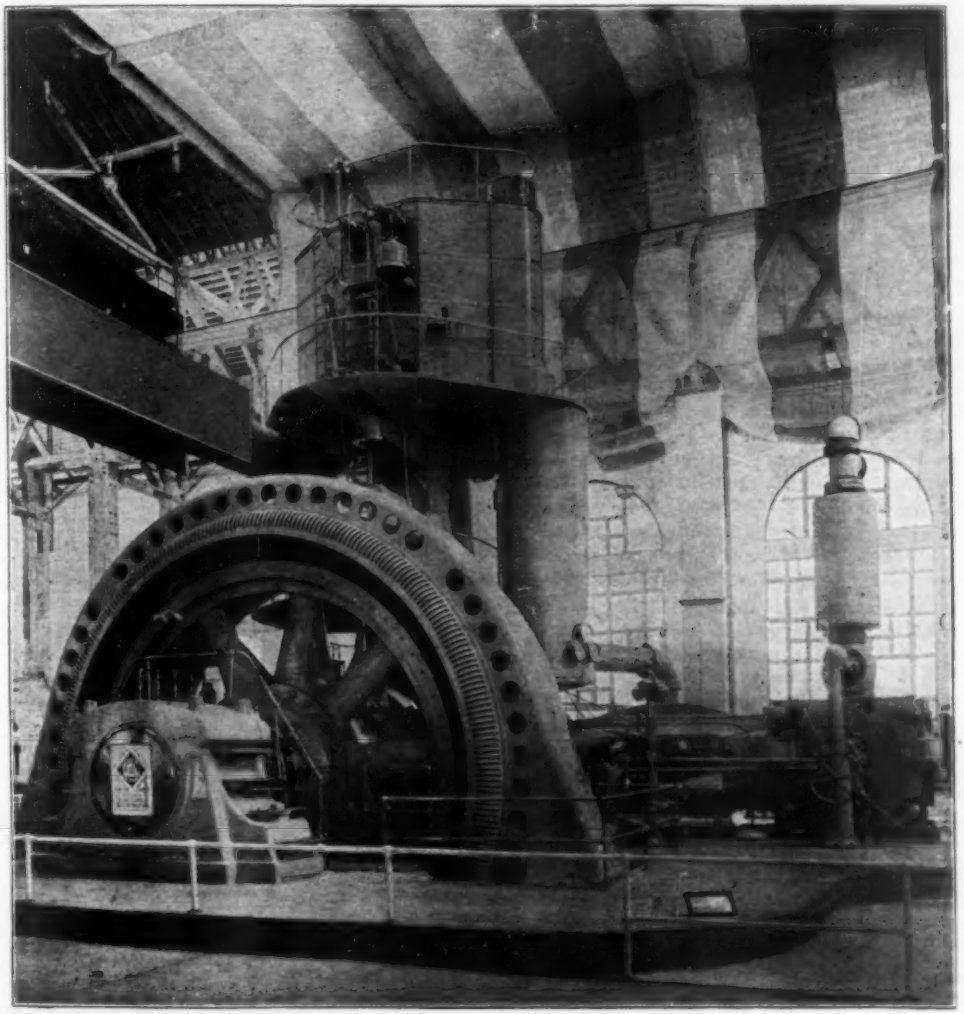
It is also said that the wages paid for this work, while higher than those received by skilled mechanics, who have spent several years in learning a trade, are not sufficiently great in proportion to the severity of the work to attract as competent a class of men as formerly. Muscle is a prime requisite whether there is good judgment along with it or not. In other words, while firing is work which demands brains, it simply cannot be done by a man of inferior strength. Even the strongest cannot do their best work after the first few hours of a trip, owing to fatigue. In some cases this has been remedied by using two firemen who relieve each other every half hour, but this in turn makes long hours for the men.

The solution seems to be in either the use of oil which requires brains and not muscle, or in the use of automatic stokers.

Biggest Engine Ever Exhibited at Any World's Fair.

How Two Hundred Thousand Decorative Incandescent Lamps Are Lighted.

The most notable exhibit in Machinery Hall at the World's Fair is the big 5,000 horsepower engine and electric generator. The engine is of the Manhattan type and is the largest single engine of its kind ever made and by far the largest ever shown at any world's fair. When worked to its full capacity it is capable of producing 8,000 horsepower and aside from being an exhibit, much of the beauty, convenience and success of the Exposition depends upon it. It furnishes the electric current for nearly two hundred thousand 8-candle incandescent lamps during the evenings and for five hours every afternoon furnishes current for a street car line from St. Louis to the Fair



The Big Engine and Generator that Keep 200,000 Incandescent Lamps Aglow.

Grounds and it is often called upon to supply current for many less important functions.

The gradual brightening of the thousands of decorative lights at eventide and the recreation of the wonderful picture of the World's Fair and its features after its fading into the gray of dusk, is one of the most beautiful sights at the Exposition. Dimly, at first, a glow of red, like a remnant of sunset appears along the outlines of the buildings. Slowly it grows brighter until the whole picture seems to be done in fire and then, with stronger current, the lamps grow gradually white in incandescence and the picture is complete.

Visitors standing near the engine may see how this is accomplished. At one corner of the exhibit stands a square cage filled with grid-iron shaped pieces of metal. This is a rheostat and its purpose is to absorb the current created by the exciter for the generator of the engine, and hold it back until it is wanted. On its face is an arm which revolves across a large number of pieces of copper. As this makes a turn it cuts out, bit by bit, the resistance of the rheostat. On top of the cage is a little electric motor which, by means of a chain belt, turns the arm of the rheostat. When the time for lighting arrives an operator at the main switchboard touches a button and the little motor begins to move. As the resistance of the rheostat is gradually cut out the whole number of the decorative lights over the entire Fair begin to glow feebly, but all alike, and then to gain in volume of light, all in accord, as the arm progresses about its circle. One may see the entire operation by standing beside the rheostat at dusk.

The engine is of the combined vertical and horizontal, compound, condensing type. The high pressure cylinder, which is horizontal, is 84 inches in diameter, and the low pressure cylinder (vertical) is 94 inches in diameter; its steam pressure is 150 pounds. Its shaft is hollow of forged open-hearth steel; is 37 inches in diameter in wheel and generator fits, and weighs 61,000 pounds. The crank weighs 32,000 pounds and the big fly wheel, 25 feet in diameter, weighs 300,000 pounds. The number of revolutions per minute for both engine and generator is 75. The total revolving parts, including the generator, weigh 514,400 pounds, and the whole engine 720 tons. The engine is 39 feet long and stands 39 feet 2 inches above foundation.

The rated capacity of the generator is 3,500 kilowatts. It is of the direct-connected, revolving field type. Its current is 6,600 volts, 25 cycles, 3-phase. The pole pieces number 40. Its collector rings are 51 inches in diameter and the stator yoke 27 feet in diameter, 33 feet over all, and weighs 58,000 pounds.

Words and figures hardly suffice to convey the size and power of this remarkable engine. It is one of the attractions which must not be missed.

A MORTUARY CANOPY.

Funeral directors have accomplished a great deal, and are constantly adopting new methods and mechanical devices which are calculated to make the sad occasion of their visit one of comfort and sympathy, and to avoid everything calculated to intensify the grief-stricken home.

The Canopy.

The automatic mechanism which, without the touch of human hands, gently and noiselessly lowers the casket through a wealth of flowers, is something that has replaced the bungling efforts of inexperienced though well-meaning friends with a substitute at once beautiful and appropriate.

Another feature now in favor is the couch on which the remains are laid while in the home, and the canopy with which it is covered. These are made of imported netting and richly trimmed, the usual colors being white and lavender, all white, gray, black and lavender, all lavender, black and purple, and all black. The canopies are appropriate used for either adults or children's caskets or funeral couches. The illustration shows the manner of its use.

Trent Canal Hydraulic Lift Lock.

Raises 1,300 Tons---Only One of its Kind in America, and the Largest in the World.

View of the Hydraulic Lift Lock from the Lower Reach.

Think of an elevator with the platform 140 feet long and 33 feet wide, lifting 1,300 tons 65 feet vertically; think again of the 1,300 tons including a good sized steamer, its load of freight and passengers and the necessary water to float it, all being lifted together and the entire operation performed in only four minutes, and you have a good idea of one of the latest and most remarkable feats in modern engineering.

The Peterborough hydraulic lift lock, which has just been completed and opened for commerce, is the only lock of this kind in America and one of but four in the world of which it is very much the largest and most interesting as an example of hydraulic engineering.

The Trent canal is not, in the most exact sense, wholly a canal, as almost the whole distance from Lake Huron to the St. Lawrence is through lakes and rivers or on flooded reaches. The length of the route from the Bay of Quinte to Lake Huron is about 200 miles. When completed it is expected that only about 20 miles of this distance will be actual canal. Where canalling is necessary the prism of the canal has a width of 50 feet on the bottom with side slopes in earth of 2 to 1, and in rock ¼ to 1. The slopes in the earth are protected by broken stone placed in a notch cut into the slope.

The standard size of the locks is 134 feet long, 33 feet wide, with 6 feet of water on the sills—though all the lands bought so far for canal purposes have been surveyed and laid out to allow eight feet of water on the sills of the locks. To make all the works so far constructed of the same capacity, would only mean holding the water two feet higher on the sills of the locks by means of extra stop logs placed in the dams, and a slight extra expenditure for the purpose of adapting the present works to the increased depth of water.

The hydraulic lift lock at Peterborough was built to overcome the fall in the waters of the river Otonabee between the two

points, Nassau, about four miles north of the town, and Little Lake, a broadening of the river, opposite the town. The difference in elevation between the two points is 77 feet, the river having that fall in the distance indicated. Above Nassau and up to Lakefield between which points the fall in the river is very pronounced, the river is canalized and made over into several stretches of still water, with locks of the ordinary type between the stretches. Of the difference in level referred to above Nassau and Little Lake, 65 feet is taken care of by the lift lock, the remaining 12 feet being overcome by a lock of the ordinary type placed at the debouchure of the canal into the lake.

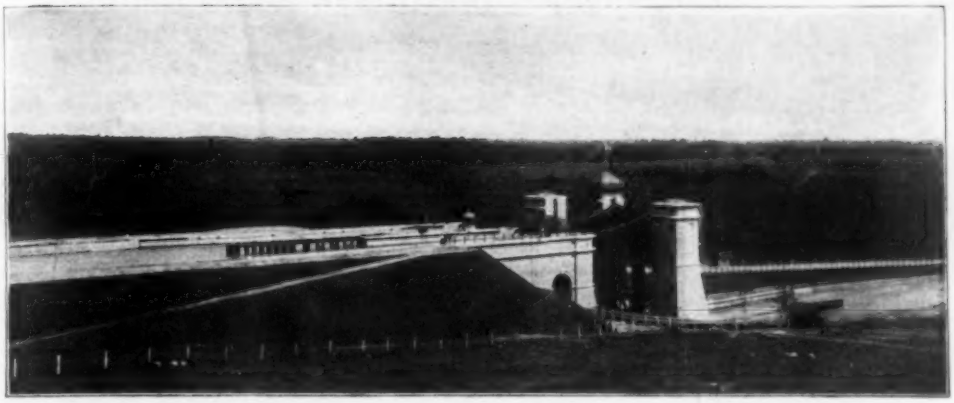
The movement of the lock proper is based on principles long known and well established in the sciences of hydraulics and hydrostatics. Hydraulics relate to the water in motion. Hydrostatics to water at rest. If one takes a cube of iron, say four inches square each way, and drops it into a pail filled to overflowing with water, the piece of iron will sink and displace exactly as much water as will be equivalent to the bulk of the iron. If the iron were hammered or spun, into some form of vessel or dish that would float, then the piece of iron in its new form would displace water exactly equivalent to its weight. So that anything that sinks displaces its bulk of water and anything that floats displaces its weight of water. The application of this principle is seen in the filling of the chambers with water or with boat and water. Fill one chamber with water to the depth of 8 feet, in the other chamber place a barge and water to the same depth, and the load in both chambers will be exactly the same. Hence lockages may be effected with one barge or boat in a chamber, with barges in each chamber, or with the chambers containing water only.

Calculation made of the cubical area of the chamber shows that the load of water is about 1,300 tons (about the equivalent of the weight of 13 of the heaviest locomotives). The duty which the huge ram or piston is called on to perform exceeds this: There is the additional weight of the cantilever or truss construction supporting the chamber, and the ram itself, in all about 1,700 tons.

The special functions of the Peterborough lock are, first, to overcome the elevation; second, the time in which this duty is to be performed, third, the quantity for a given number of lockages or maximum number of tons handled, avoiding a congested traffic. The question for the department of railways and canals to decide was whether the lift should be overcome by locks of the ordinary type, or by such form of lock as that under construction. If of the ordinary type then at least five locks would be required. When these were in use, boats and barges would have to wait until the five lockages had been effected before gaining access. To avoid such delay the locks would have been built in pairs, as is the case at Lockport, on the Erie canal. The cost of these ten locks would have far exceeded the outlay for the hydraulic lock. The time of lockage would have been a serious hindrance to traffic, the attendance a very serious item and the service would have been slower, continually interrupted, and the capacity of the canal at this point restricted. Hydraulic lift locks are planned and built to serve the future as well as the present and to provide for expansion.

The operation of the lock requires three men—a lockmaster, and two assistants or gatemen. The lockmaster will be in charge. The gatemen will be required, one at the lower end and the other at the upper, to open and close the gates, to inflate or deflate the seal tubes between the ends of the chambers and the reaches, and to operate the capstans. It is also necessary for the gatemen to take charge of vessels at a distance of about 200 feet on either side of the lock. The lockmaster, during operations, will be required to stay in his cabin, on the top of the central tower, where he will have full view of all that transpires, and also be in communication with both his assistants by a simple signal system. The lockmaster will have the principal levers before him and through an interlocking system will regulate all the workings of the locks. The levers for controlling gate engines and capstans are situated on the wall immediately above the respective machines, convenient of access to the gateman. The interlocking system is so arranged that the lockmaster must set his levers in the proper order, and these having been set neither he nor his gatemen can err by using their levers at the wrong time.

It is intended that the actual time required in raising the chamber through the whole elevation will be about three minutes. But this will depend upon the adjustment of the main glands, the nicety of the working of the guides and the manipulation of the main valve in the hands of the lockmaster.



General View of the Lock with the Trent River Valley in the Distance

In the European locks this part of the lockage is readily performed in three or four minutes. An ordinary lockage will be conducted in this manner: Suppose 100 tons of "surcharge" has been found to give sufficient additional weight to the descending chamber. The uppermost chamber will then be required to stop with its floor 8¼ inches lower than the bottom of the upper reach. On communication being established between it and the reach, it will receive from the reach 100 tons more than the lower chamber contains, assuming the depth in both reaches to be the same. The total operation to form the lockage, assuming that the gates adjoining the reaches are open and that the seal tubes between the chambers and reaches are inflated, will consist in hauling the vessel into the chamber and mooring her there securely, closing the gates, deflating the seal tubes, and opening the main valve between the presses. The heavier chamber will commence to descend, the motion being allowed to increase gradually by the gradual opening of the valve, until it reaches the maximum speed. At about three quarters of the stroke the main valve is slowly closed, communication between the presses being entirely cut off when the end of the journey is reached. The change in elevation being made the seal tubes are inflated, the gates are opened and the vessel or vessels are free to go on their journey, after being towed out by the capstans. The surcharge contained in the descending chamber simply flows out into the lower reach, while a similar quantity to perform the next lockage is admitted into the chamber which has just reached the higher elevation.

Statistics: Total height, 100 feet; height of lift, 65 feet; breast wall of lock, 40 feet thick, 80 feet high, and 126 feet long; weight of water in each chamber, 1,300 tons; depth of water in chamber, 8 feet; each chamber is 140 feet long, 33 feet wide, 9 feet 10 inches deep, steel; superstructure, concrete 26,000 cubic yards; pressure in operation, 600 pounds per square inch; excavation commenced in 1896; concrete work commenced in 1900; cost, $500,000.

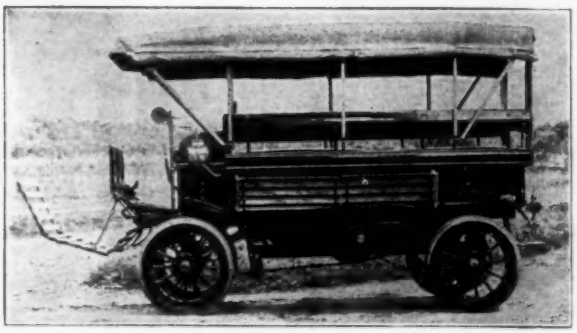
The advantages claimed for the hydraulic lock over those of the ordinary type are saving of time, economy of water and increased capacity. With reference to capacity it will be noticed that vessels traveling in opposite directions may be locked through simultaneously.

A "HOSPITAL TOWN."

At a cost of approximately $8,000,000 Vienna is to have the greatest hospital in the world. It will cover an area of 2,400,000 square feet, and will be in itself a small town having 40 separate buildings in all, 32 of these being clinics and hospitals and 8 offices and residences for the staff.

There will be 18 complete and separate hospitals built on the pavilion or cottage plan and including sick wards, operating and lecture rooms. About 2,300 beds will be provided and each patient will have 1,030 square feet of space. The clinics will all have flat roofs with gardens, for the benefit of consumptives in particular. The operating rooms will be magnificent and of an entirely new type. In clinics for infectious diseases a glass partition will separate the patient from students and professor.

Motor Transfer Service



Colonial Auto Bus

A Pittsburg transfer company now have in use four big colonial 'busses for transferring passengers and baggage. Each of the cars accommodates fifteen passengers comfortably, and has two folding side racks which can be let down for carrying luggage, and a folding rack in front for mail pouches. By leaving off the racks the vehicle can be converted into a patrol wagon.

The machine has a wheel base of 96 inches, 56 inches gage, and weighs, complete, 3,580 pounds. The wheels have solid 4-inch rubber tires.

MILITARY EXPERIMENT COST $500,000.

One of the most interesting and also most expensive military tests ever made recently took place in Germany. It consisted in the erection of a strong, wide bridge over the Elbe by three regiments of military railroad builders in a few days' time. The bridge was built in sections which could be quickly and easily put together and was capable of bearing heavy artillery and army transport. If one section of such a bridge is destroyed by shells or fire another can be quickly substituted. The bridge can be adapted to streams of any width.

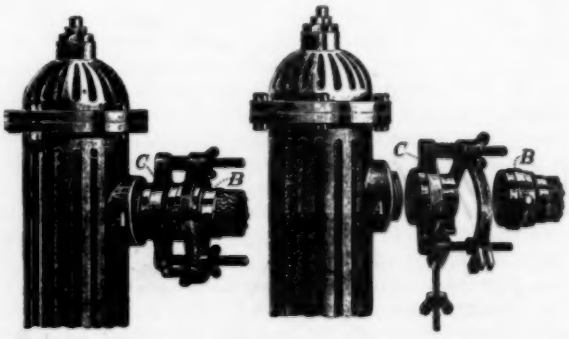
Every precaution was taken to keep outsiders from viewing the bridge or photographing it. The cost of material for the structure and the military experiment amounted to $500,000.

LARGEST TELESCOPE IN THE WORLD.

The largest efficient telescope in the world is to be added to the equipment of Harvard University. The new instrument is 27 feet in focal length and has a 5-foot aperture—nearly twice as large as the Lick observatory telescope, which has a 36-inch aperture. The telescope will be used chiefly for photographic work.

Fire Hose to Fit Any Hydrant

Our readers will remember the prediction made at the time of the Baltimore fire, when fire companies from other cities were unable to connect with the Baltimore hydrants, owing to their hose couplings being of a different size. Such necessities are not long unprovided in these days, and the cut shows a device now available which permits of hose connection to any hydrant, larger or smaller. This makes "connections" of all cities and towns interchangeable, and an absolutely tight joint can be secured in from two to seven seconds. The price of the coupling is $10.



Universal Hose Connection

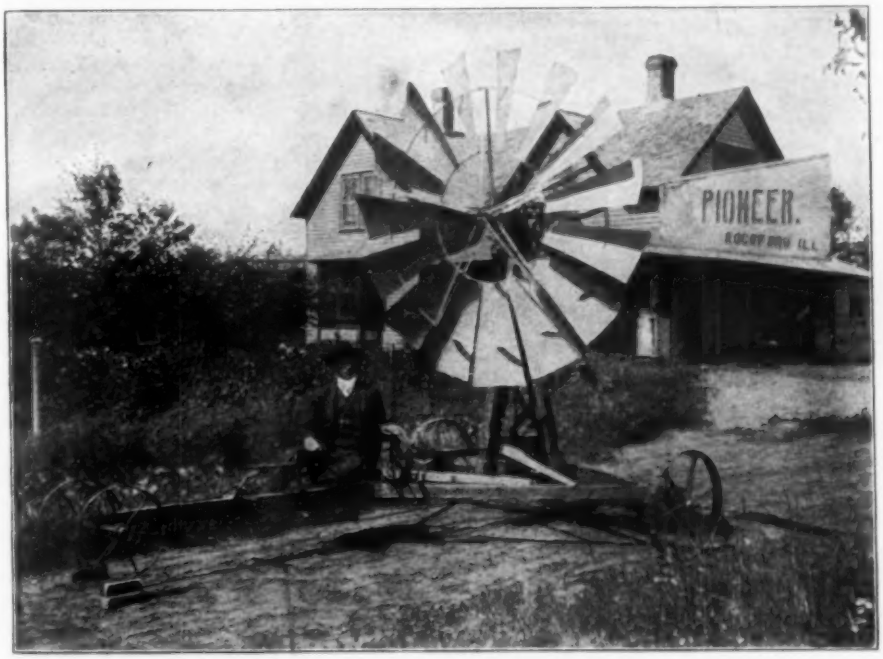
A Windmill Automobile.

Strange Craft that Sails Best Against the Wind--Only Machine of Its Kind in the Country

Somewhat of a novelty in the way of windmills is a traction windmill, contrived by Geo. C. Phillips, of Webster, S. D. There is but one of these machines in this country.

The frame on which the tower is built is a triangle, the center beam is a 2x6, 12 feet long, resting on the guide wheels at the front and on the axle at the rear. Two 2x4's extend from this beam at about half the distance to the outside of the rear. Ten inches in front of the axle is another 2x6 extending crosswise and resting on the beam and side bars thereby forming a triangle that will not rock. Two legs of the tower rest on each beam.

The wheel is an 8-foot steel pumper, remodeled into a geared mill by using some old gear. The windmill is all built of old gear and it was quite a task to find the right sizes and kinds. At first the vane was used, but as this would not hold the wheel in the wind when it was pulling hard, the gear was attached in such a manner that now the wheel can be regulated with the left hand and the speed, also. There are times when both hands are needed and so a screw is used for a steering device and it will stay where it is set.



"The Machine is 12 Feet Long."

This machine runs best against the wind. Of course, it will move sidewise to the wind or with it, but always the best against it. In a good wind it will move about three miles an hour and it could be made to run faster.

The machine is 12 feet long, 9 feet wide and 12 feet high, weighing about 800 pounds. The inventor does not take the machine on the road often as it frightens horses.

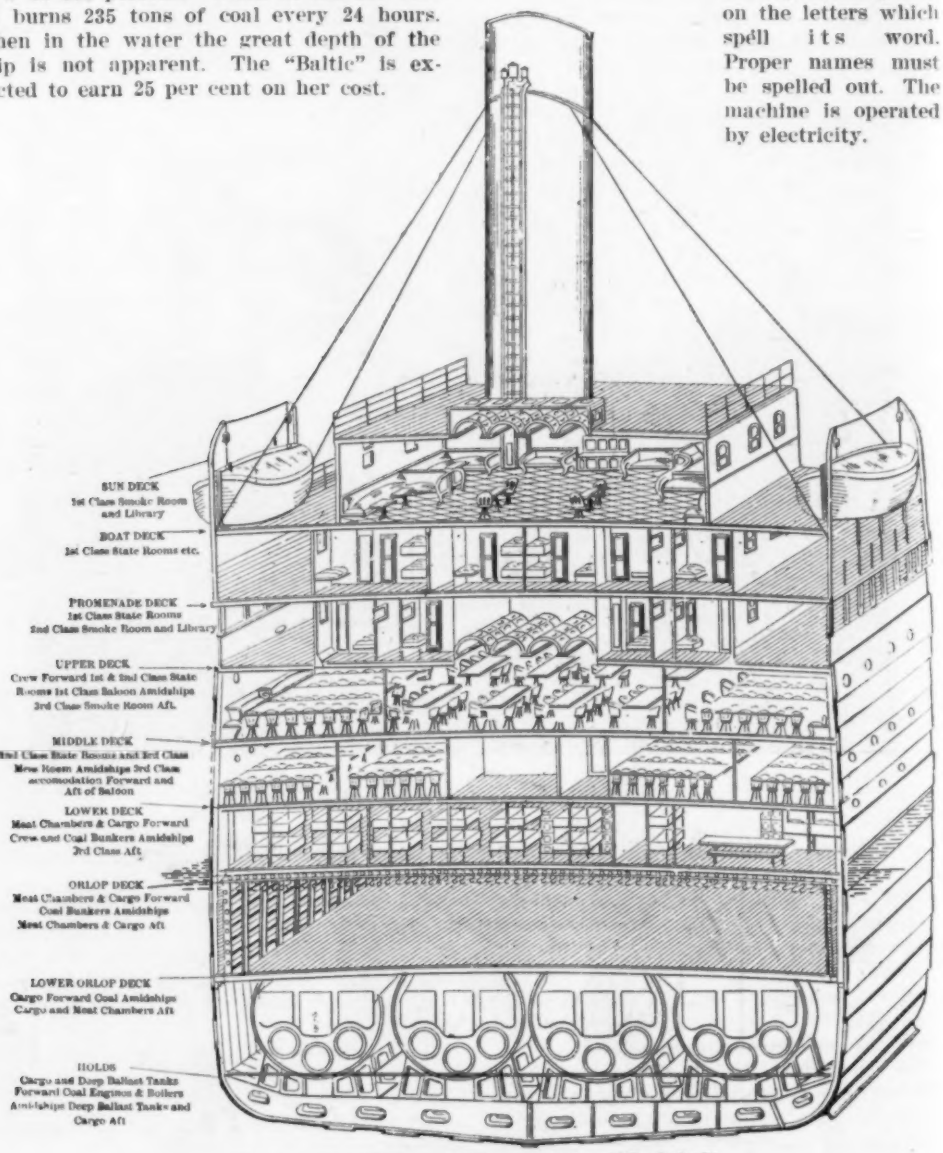
STEAMSHIP EIGHT STORIES HIGH.

A view of how the "Baltic," the largest vessel ever built, would look if cut in two, is given in the illustration which is taken from the American Machinist. The "Baltic" is 735 feet long, 75 feet wide, and is 35 feet longer and has 1,500 tons greater tonnage than the "Great Eastern." Her displacement is 40,000 tons; tonnage, 24,000 tons; can accommodate 3,000 passengers, and carries a crew of 350 persons. When at sea the vessel burns 235 tons of coal every 24 hours. When in the water the great depth of the ship is not apparent. The "Baltic" is expected to earn 25 per cent on her cost.

MECHANICAL STENOGRAPHERS.

It is reported that a Cincinnati inventor has perfected a machine which reproduces in typewritten form the words spoken by a human voice into its receiver, including a vocabulary of 2,500 words and, if needed, can be adapted to the use of other words.

The machine has a small copper disc for each of the 2,500 words and the spoken word acts only on its particular disc, which, in turn, acts on the letters which spell its word. Proper names must be spelled out. The machine is operated by electricity.


SUN DECK
1st Class Smoke Room and Library
BOAT DECK
1st Class State Rooms etc.
PROMENADE DECK
1st Class State Rooms
2nd Class Smoke Room and Library
UPPER DECK
Crew Forward 1st & 2nd Class State Rooms 1st Class Saloon Amidships 3rd Class Smoke Room Aft.
MIDDLE DECK
2nd Class State Rooms and 3rd Class Mess Room Amidships 3rd Class accomodation Forward and Aft of Saloon
LOWER DECK
Meat Chambers & Cargo Forward Crew and Coal Bunkers Amidships 3rd Class Aft
ORLOP DECK
Meat Chambers & Cargo Forward Coal Bunkers Amidships Meat Chambers & Cargo Aft
LOWER ORLOP DECK
Cargo Forward Coal Amidships Cargo and Meat Chambers Aft
HOLDS
Cargo and Deep Ballast Tanks Forward Coal Engines & Boilers Amidships Deep Ballast Tanks and Cargo Aft

Cross Section of Steamship "Baltic"

Mechanical Figures Almost Human.

Talk in Several Languages, Walk, Ride Bicycles, Write and Breathe---Appear to be Alive, and Do Almost Everything but Think.

It was a dingy loft-like place, away back in the rear and at the top of an old building in Chicago. The door was closed and locked and the big sign of "Positively No Admittance" was anything but encouraging. The first attempts at the little push button apparently accomplished nothing but to sound a big bell somewhere. After awhile the door was opened, and a little old man in the most ancient straw hat and puffing vigorously at a cob pipe, stood before me. My errand was quickly stated and after looking me over for fully half a minute, he evidently relented and bade me enter. Fortunately I had happened on one of the days when he was inclined to talk.

I followed along, threading my way in the dim light between ghastly rows of half-formed men and women. A motley assortment of arms and legs were hanging from the walls, and heads in various degrees of construction lay on boxes or tables where they had been carelessly thrown, and interspersed were hands and ears, while a nose was stuck on a nail which protruded from a packing box.

Then came the work benches and here were tools the shape and purpose of which I could not guess. Above the benches, which were covered with all manner of materials, rose long shelves crowded with the most motley collection of brass rods, springs of every imaginable description, screws, wires, bunches of human hair, handfuls of glass eyes, bottles with strange smelling chemicals, magnets, electric motors, storage batteries and hundreds of things the purpose of which no man could imagine.

It was the work shop of a genuine twentieth century mechanical wizard.

"So you want to see the 'figgers,' do you?" said he, as we paused at the end of the room where a little better light was struggling through some very grimy windows.

"Well, I'm pretty busy, so you just talk to this young lady here, and she can tell you all about it," and his eyes seemed to twinkle mischievously, which at that time I attributed to the smoke from his stalwart pipe.

"Nellie, this is one of those editors from that Pop'lar Mechanics, you just tell him all about how we make 'em."

In every feature she was beautiful as she sat leaning back in an arm chair, gowned exquisitely in garments of the latest style and evidently of expensive material. "Must

"Nellie, Exquisitely Gowned, Sat Leaning Back in an Arm Chair"

be the old man's daughter, but what a place for her here," I thought as she rose in a queenly manner and gracefully extended her hand.

"I am very glad to meet you," she said in a rather captivating tone. "Won't you be seated?"

Her large brown eyes looked steadily at me through a bit of lace veil that certainly was very fetching, but the unexpected meeting, and an indescribable sense of horror at taking her hand which was decidedly

clammy, combined to upset me somewhat, so I stammered out, "Yes, I guess so, thank you," but remained standing.

"Yes?" she remarked with a rising inflection.

"I came up to get acquainted with the figures, and learn something of their construction," I remarked.

"It's a very pleasant day," she replied, with a suggestion of changing the subject.

"And I am anxious to find out the mechanical features of their construction—"

"Are you fond of golf?" she interrupted.

"And what motive power is employed, springs or electricity, or —"

A bust of merry laughter, a coquettish toss of the head and a gesture which apparently dismissed the subject was my response. Then she swept majestically past me and stepping over to the window stopped and appeared to be looking out.

"Well, how are you coming on?" said the old man who had returned.

The young lady at this juncture turned and remarked—

"I believe I would like to ride my wheel."

"Crazy," I muttered, "and no wonder in such a crazy place as this."

Her father cleared a space on the floor and bringing out a bicycle assisted her to mount, which she did in a rather amateurish manner, I thought.

"All ready," he said, and thereupon the fair one began to circle the room, riding steadily and smoothly, but with increasing speed, until I trembled for her safety. Time and again she barely missed striking some obstruction, but each time flew past unharmed. In about two minutes he reached out and brought the wheel to a standstill and assisted her to a chair. She appeared to be considerably out of breath from the violent exercise, and the gold locket on her bosom was rising and falling vigorously.

"She took me two years, and cost $3,000," said he slapping me on the back, "but she's worth it."

It was beginning to dawn upon me that this cheerful beauty with the highly informal manner was a mechanical creation of this strange genius. And so she was.

Those work shops were a revelation. It seems impossible that a few inanimate materials could be made to assume so many of the human attitudes with such startling similarity to life. There were women in street, travelling and ballroom costumes, which, when touched by the wizard's hand cleverly imitated the manners of well-bred society, handling their fans with perfect ease and assuming the most natural attitudes.

There were others who spoke in almost any language one might suggest. One woman chattered away as she perked her head first to one side and then the other, carefully applying a face cream to a complexion that was already without blemish, and actually breathed as regularly as though she were human. She will soon be seen in a store window and wondering crowds will block the sidewalks in front. In a comfortable chair in one corner of the room a man sat at ease and his gaze followed us as we moved about. He, too, was a talking figure.

The figures have meant years of toil, a watchfulness of details almost too painstaking for even the twentieth century, and not only a great deal of mechanical ingenuity, but a thorough knowledge of anatomy, also. The result is most startling. The foundation of the figures is entirely of papier maché, making them durable and light, but the exposed parts of the body, arms, hands, shoulders and head are beautifully covered with wax, delicately and naturally tinted, as with the pink flush of good red blood. Natural eye brows, lashes and beautifully arranged hair add their part and then the figure is dressed with care and taste.

For the talking figures small phonographs are placed within the chest and of course, records in any language, for any conversation, song, speech, laughter or sound desired can be placed and replaced when wished. The talking mechanism is the least marvelous feature of all.

The details of construction and methods of joining the parts of the body, and especially the application of equilibrium are carefully guarded secrets of the maker. Even if a skilled mechanic had a walking figure as a model it would be extremely difficult for him to make one just like it do the same movements. These secrets are the result of years of study and experiment. Some of the smallest details cost weeks of unbroken work, while others were the result of scores of fruitless trials covering a period of years. This much I learned: The arms and legs are drawn up by specially constructed rubber cords which are set in action by the movement of a lever released by a magnet, all concealed within the limb. The extension or straightening out of the arm or leg is accomplished by wires moved by strong magnets connected to a light but

powerful battery placed in the trunk of the body. In the walking figures the equilibrium is maintained by a tube of mercury which passes from the front to the back at the base of the trunk near its center. All the motions of the eyes, head and limbs are electrically operated or controlled from delicate apparatus in the head. A comprehensive, detailed explanation of just how all this is done would require many pages and be understood only by an expert electrician.

One of these figures, now on exhibition on the stage, deports itself in such a natural manner that many an audience believed it was being made sport of by a human being. To overcome this impression the figure is disjointed before the people; its wig removed and a small electric light inside the head turned on to show that the figure is run by springs and batteries instead of gray matter. This figure walks out on the stage and makes a speech; is then mounted on a bicycle having curved handle bars, its feet placed on the pedals and without further assistance or support rides around on the stage. When removed from the wheel it walks to a blackboard and writes its name, "Elmer Miller," in a hand sufficiently legible to be read by the audience.

The idea of these figures is being used for other purposes than displays in shop windows. Very life-like pigs which squeal, grunt and root around is one of these and a big packer has ordered several thousand of them for advertising purposes.

The work of perfectly imitating both human and animal life is certainly an ambitious one, and has been favored with a remarkable degree of success.

A Mechanical Figure Which "Speaks Six Languages Fluently"

KILLING WEEDS ON SHIPS' BOTTOMS WITH ELECTRICITY.

The growth of weeds on the bottoms of ships and also the oxidation of the plates may some day be prevented by electrolysis. The plan is feasible in nearly every particular save cost, and this may in time be decreased.

The ship's plating is made the negative pole and insulated copper pieces the positive pole of an electrolytic cell through which the current, generated by the ship's dynamo or a battery, is passed. Hydrogen, liberated from the sea water, prevents oxidation of the plates, whilst the resultant caustic soda kills all barnacles and weeds.

The working cost, however, must be considered. For a 300-foot ship, having 15,000 square feet of wetted surface, three amperes would be required to keep pace with the scouring effect of the ship's passage through the water. To be effective the work must go on all the time, both day and night at a cost of about $5 an hour or $120 per day, a considerable sum to add to a ship's working expense. It would also be necessary to carry a 225-kilowatt dynamo outfit.

THE GREAT AIRSHIP RACE.

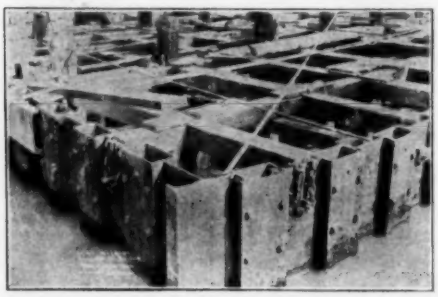
Considering the wide publicity of the affair, the outcome of the airship race from the Fair Grounds to the Washington Monument falls nothing short of ridiculous.

For the wonderful aerial craft were substituted two balloons, such as feature every circus that strikes our villages. The first balloon, after remaining in the air two hours and a half, came down in a cornfield, and was shipped back to St. Louis. The other wandered at will until in the vicinity of Wyoming, Ill., and then came down.

COFFERDAMS OF I-BEAMS.

The New System of Interlocking Steel Sheeting

A new system of building cofferdams, making deep water excavations or other deep excavations is being demonstrated in Chicago, and engineers everywhere are asking themselves why someone did not do the work this way years ago. Like many another great thing, its simplicity is its most remarkable feature. The new system consists in bolting two channel irons together, forming a hollow iron tube, which is connected to the next tube by an I-beam of



Cofferdam--Chicago River

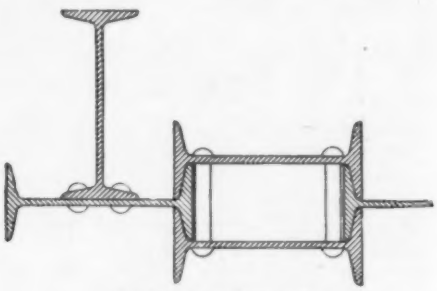
standard size. The tubes and I-beams are driven by a pile driver, the same as piles.

For this work nothing special is required. The I-beams are standard, 18 inches wide, and weigh 55 pounds to the foot; the channels are 15-inch channels, weighing 33 pounds per foot.

The illustration shows the manner of connecting the sheeting, which may be extended to any desired distance. At the corners an L is formed by riveting two I-beams together. There is no limit, within reason, of the height to which the steel sheeting is made. In practice here in Chicago as little as four feet in earth has answered to hold the sheeting for 19 feet above; probably six feet has been the average here. Where the excavation is deep or the work of retaining heavy, inside bracing of timber must be used. The sheeting has been spliced and driven here to a length of 40 feet.

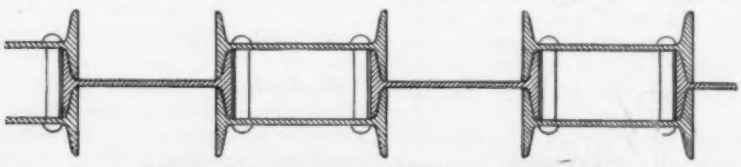
One highly desirable feature of the method is the comparative ease with which the sheeting can be pulled when its purpose is served. It can then be used again indefinitely. The channels, beams and bolts are all standard, and can be bought in any large city out of stock. For work in water the sheeting is made practically water-tight by filling the columns with clay.

Already in Chicago the new method has been used with great success in a cofferdam in the Chicago river, where the water is 20 feet deep and the excavation within the dam was 31 feet deep; also in tunnel work on the lake front, and to retain the foundations and earth beneath, under one



Plan of Corner

of the large pumps in the Chicago avenue city pumping station. At this place we made a careful examination and in spite of the constant operation of the immense pump, which is of the walking beam type, there appeared no settling or cracks after three



Plan View of Connecting Sheeting

retaining wall can be carried. The wall is made by driving to a suitable depth; the bottom end is not sharpened, but will go through almost anything except, of course, stone. The nature of the soil has much to do with the length which must be left completely in the ground after the excavation

weeks' operation. The sheeting was driven within a few feet of the pump and an excavation 40 feet square made to a depth of 20 feet. The new system, which is patented, can be rented for periods of 90 days or more and effects a great saving over the use of wooden piling.

Floating Church a Boon to Seamen.

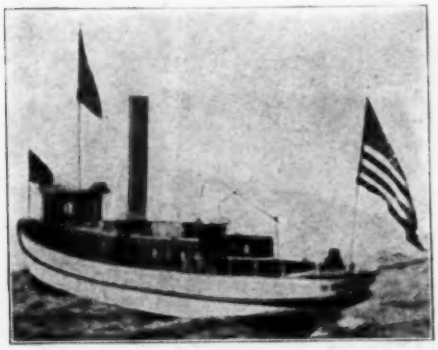
At the foot of Pike street, New York, not far from where all the great lines of the Atlantic land their mighty volume of traffic, floats an unusual little craft which year in and year out never leaves its moorings and yet is most popular among thousands of sailors. It is in fact a floating church built upon a scow 85 feet long and 45 feet wide. The structure was completed in 1879 at a cost of $25,000 and since that time many are the seamen who have had reason to bless it. It is supported by the Protestant Episcopal Church Missionary Society, of which notorious Bishop Potter is president, and which also maintains a reading room and gymnasium for the sailors. Services are held regularly in the little church and a steam launch 70 feet long with a carrying capacity of 50 persons brings the sailors from the vessels in the harbor to the church and returns them again. This mission boat "Sentinel" also visits incoming and outgoing vessels and those in port as well and ministers to the needs of the seamen.

Interior of the Floating Church.

The gymnasium and reading room are to the sailor like a bit of the homelife he often longs for, but

Floating Church for Seamen, New York.

can rarely enjoy. Last year 441 religious services were held in the floating church with a total attendance of 20,099 seamen.



Mission Boat "Sentinel"

The good work of the society is especially apparent in the number of letters the sailors write to and receive from their families and friends and in the increased amount of money deposited for safe keeping. A Free Shipping Bureau obtains employment for sailors, and a Legal Aid Society investigates all complaints.

GEARLESS AUTOMOBILE IN FRANCE.

A firm of French builders have produced an electric automobile which is gearless. The armature of the motor has for its shaft the axle of the vehicle carrying the driving wheels. At a recent test the machine ran on speeds ranging from 4½ to 19 miles an hour. The machine is noiseless. Gearless motors were tried in the United States on street cars some years ago but were not an entire success and few if any are now in use.

MANUFACTURES POLES

So far as good straight poles are concerned, it will matter little hereafter if our forests deteriorate and the trees grow crookedly. A big factory, equipped with the finest machinery of its kind, for manufacturing poles which are stronger than they were in the natural state, has just been established at Little Rock, Ark.

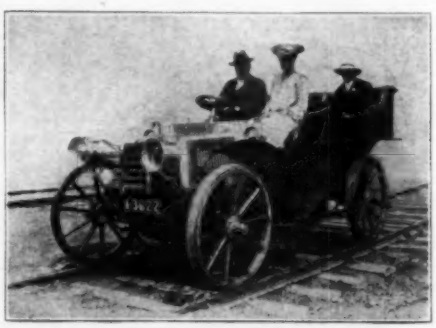
The lathes take a 30-foot stick and if it is crooked it is straightened on the tenon and socket plan. Each joint is straightened by an iron band imbedded in the wood around it. The poles can be built to heights of 50 or 60 feet if desired and are shipped in sections. They are built from any length of timber, yellow pine being used, but are not jointed under 30 feet. The base is made separately in the form of a sleeve into which the pole slips. The base is creosoted to preserve the wood and the entire pole is chemically treated and painted either red or green. In the United States 33,000 poles are used per day.

AUTOMOBILES THAT RUN ON RAILROAD TRACKS.

The railroad companies are not likely to look with special favor on the new steel-flanged wheels which are a recent English invention, and which enable an automobile fitted with them to travel safely and with great speed on a steam railroad track.

Charles J. Glidden, who is attempting to encircle the globe in his auto, has received a set from London, and with permission already obtained from the Canadian Pacific, will use that track across the continent, starting from Minneapolis. The auto will follow a passenger train at a respectful distance, and will be in charge of one of the company's conductors as long as it is on the road, which it will be for 2,000 miles. Train orders will issue the same as for any extra train, and it will run as a second section of a regular passenger train.

The Automobile says: "This is the first

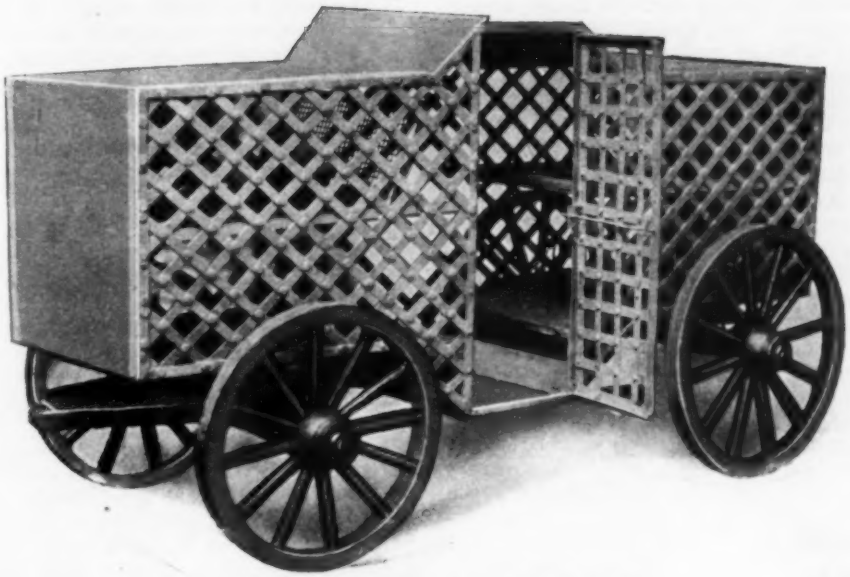


"No Steering Necessary"

occasion on which a regular road touring car has been fitted with flanged wheels for railway travel. The wheels are stoutly made of ash and closely resemble the ordinary automobile wheels, except for the rims. Each wheel weighs 250 pounds."

Mr. Glidden has sent several barrels of gasoline ahead to insure a supply at places where autos are unknown, and expects to average 30 miles an hour while running. No steering will be necessary, as the wheels will follow the rail.

Portable Jails in Which Convicts are Caged at Night



A Portable Steel Convict Cage

In many of the southern states convicts who work on the public roads by day, often some distance from the jail, are now caged for safe-keeping at night, instead of being returned several miles to the jail or placed under an expensive and uncertain guard.

Portable steel cages are used for this purpose. Each cage is 14 feet long, 3 feet 6 inches wide and high enough at the entrance for the prisoner to stand erect, while the ends which are equipped with four bunks each, are not so high. The floor, ceilings and ends of the cages are made of heavy steel, while the sides are of 3/16x2-inch steel bars, set obliquely at right angles to each other and riveted together by ⅜-inch rivets. The cages are easily drawn by two horses.

RAILWAY RUN OF 245¾ MILES MADE DAILY WITHOUT STOP.

The longest non-stopping railway run is made twice daily in England between Paddington, a suburb of London, to Plymouth, Truro, Falmouth and Penzance down in the Devonshire and Cornwall district. To realize how great this distance to be made by established daily runs without stop one has but to take a map of England and trace the course of the Great Western road over which the run is made.

The morning express leaves Paddington at 10:10. The average speed of the express is 55.6 miles an hour and this speed is maintained despite the fact that there are grades of 1 in 43 and 1 in 48; that through Bath and the five Dawlish tunnels the speed must slacken to 15 miles, to 10 miles around Bristol and 5 miles through Exeter. The greater portion of the distance is comparatively easy, however, and in places a speed of from 65 to 69 miles an hour is maintained. The route passes through London, Reading, Bath, Bristol, Exeter and Plymouth, where the first stop is made; then on to Truro, Falmouth and Penzance. The corresponding return run is also made daily.

No other road in the world has an established daily non-stopping run so long as this, though there are occasionally special runs made which are longer.

Adirondack Forest Fires Largely the Work of Incendiaries

The report of the U. S. Bureau of Forestry for 1903 states that the forest fires in the Adirondacks which destroyed about 600,000 acres of timber and were fought at an expense of $175,000, were in many instances started by patriotic New Yorkers from various motives, usually personal greed. Probably 75,000 acres were fire-swept by reason of fires deliberately started. In some instances they were started by men who found that fighting fires at $2.00 per day was more profitable than their usual employment; small boys who found pleasure in the excitement kindled others; hunters started fires in localities where they wished the green grass to attract the deer in the spring; berry pickers had found the fires favorable to the growth of berry bushes; ginseng gatherers' work was made easier thereby, and there was an instance where a fire was started without any apparent motive and where, had the wind veered, the incendiary would have suffered a loss. One-half of the fires due to carelessness were caught from locomotives. Spark arresters, such as were recently described in Popular Mechanics, would have prevented much of the loss.

Of all the game which suffered, perhaps the trout fared the worst, several bushels of the dead fish being washed up in one place. Two boys waded into Boquet river and captured 92 brown trout which were hardly able to move.

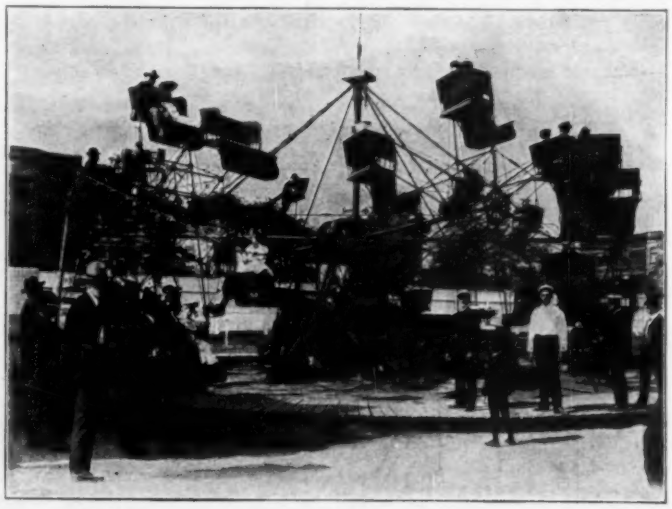
Usually the points to be protected were divided into districts, each under a deputy warden in charge of the men who fought the fires. The method of fighting surface fires was to clear a wide path of litter. If water could be obtained this path was wet down and shovelfuls of sand were thrown on burning wood. Young spruce or balsam were used to thrash out burning grass in the clearing. From the path so made the men fought the fire. Usually the presence of duff made trenches 1 to 4 feet wide necessary, sometimes such trenches completely encircled the fire.

Back firing was necessary in cases where the fires were too hot for men to fight. Trenches were dug and along the side of the approaching fire another fire was started, burning away from the trench and meeting the coming fire at a distance great enough to rob its fury of some of the danger.

There have been some prosecutions of incendiaries, one man was sent to the state penitentiary; he had started 24 fires.

ELECTRIC DOUBLE WHIRL.

The electric double whirl is a new feature for parks and pleasure resorts. It is operated by a 35-horsepower electric motor and combines the forward motion of a merry-go-round with the rolling action of a Ferris wheel. There are six of the wheels each having six seats carrying two passengers. The sensation of the double motion, which is an unusual one, is said to be quite pleasing and the first machine now in operation in Chicago has become very popular. At night it is brightly illuminated with hundreds of electric lights which form a kaleidoscope of brilliant colors and forms.

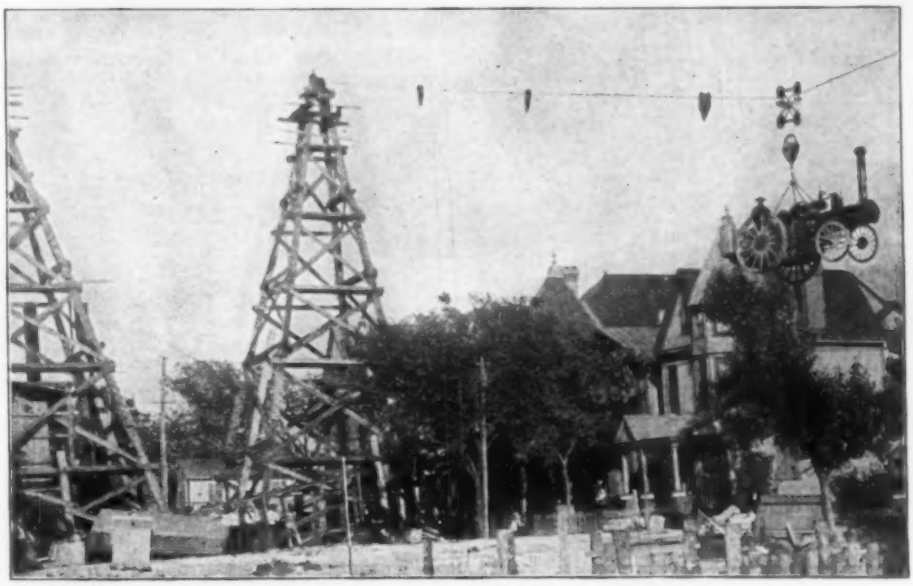


The "Double Whirl," a Delightful Amusement Device

Traction Engine Travels in the Air

Engineer Refuses to Leave His Post and Rides With His Machine

Suspended by a little ⅝-inch wire rope, so high in the air that it seemed a comparatively small object, a huge traction engine, weighing six tons, crossed the Miami river at Dayton, O., by cable to the second pier of the new Third street bridge now under course of construction. The engine was needed at the spot to pump the water from the cofferdam and the cable solved the problem for the bridge contractors, Hoglen & Kline.



Transporting a 6-Ton Traction Engine by Cable

Two tall towers support the cables on which hang travelers used to transport all material to any spot where it is required. Back of each of the two towers is a double connected drum controlling the two wire ropes which hang under the cable. The top rope pulls the traveler block back and forth; the lower rope raises and lowers the hoisting block which hangs under the traveler block. A tackle was fastened to the engine and it was raised and transported on the little rope, which, however, has carried eight tons safely. The engineer, who ran the drum had the receiver of a telephone strapped to his ears enabling him to receive directions from the other end of the wire as to the progress of his strange load. The engineer of the traction refused to leave his post even during the trip, and so he made the passage high in air, standing on the footboard of his engine. Steam was on, and he was able to signal frequently to the men below, by means of the whistle on the engine. It was one of the most unusual trips ever made by a traction engine, but was accomplished in safety.

LIPTON AGAIN IN THE RACE.

Sir Thomas Lipton has announced that it may be he is stubborn, but he cannot admit that he is beaten and will again challenge for the America's cup. Last year, after the third successive defeat in the international yacht race, Sir Thomas declared that it was his last attempt. This year he will build a new yacht, the Shamrock IV, for the occasion and declares that while his designers believe the new rules will add to his chances of success, he himself would prefer to race under the old and more stringent conditions. This would indeed make a more gratifying victory, but it is to be feared that Sir Thomas will never achieve it.

SAFETY DEVICE FOR MINERS.

A recent French invention for use in mines subject to deadly gases, enables an inspector to walk fearlessly into chambers filled with fumes one breath of which mean

Life Saving Device

instant death. The apparatus which is carried on the back, is set in action by pressing a button and immediately begins to produce sufficient oxygen to supply the requirements. Rubber tubes conduct the gas to a rubber bag carried on the breast and which is a part of a tight-fitting helmet much like that worn by a diver. The device is also suitable for firemen working in dense smoke or rooms filled with the fumes of deadly chemicals.

POLITENESS PAYS.

It frequently happens that clerks, and some others also, in answering a business call over the telephone, fail to reply with the same politeness which they would had

When Using This Telephone

REMEMBER that a stranger is at the other end of the line.

REMEMBER that the tone of your voice may make him a customer or drive him away.

MAKE a customer of him and you increase your usefulness to this office.

THEREFORE, when using this telephone always be polite, agreeable, accommodating and patient.

ACT, when you answer a call, as though it were the only bit of work you are called upon to do all day, and do it in an absolutely perfect manner.

the customer called in person. The accompanying suggestion has been printed and distributed to its patrons by a telephone company in a western city.

GEORGE WASHINGTON'S FIRE ENGINE.

Up until the time George Washington left to take command of the Continental army he was a member of Friendship Engine Co., of Alexandria, Va., which was organized in 1774. When he left he presented the company with a fire engine which was still in use many years after Washington's death, says the Firemen's Herald.

George had a reputation for prompt and efficient action, as we all know. In the last year of his life, 1799, there was a fire and this same engine was poorly manned, while many idlers stood by, unwilling to soil their clothing. Gen'l Washington was there, too, and dismounting, rebuked the loafers,

"Washington Seized the Brake"

and seizing the brake, helped work the engine. There was no lack of help after that. The illustration is taken from an old print made at the time of the incident.

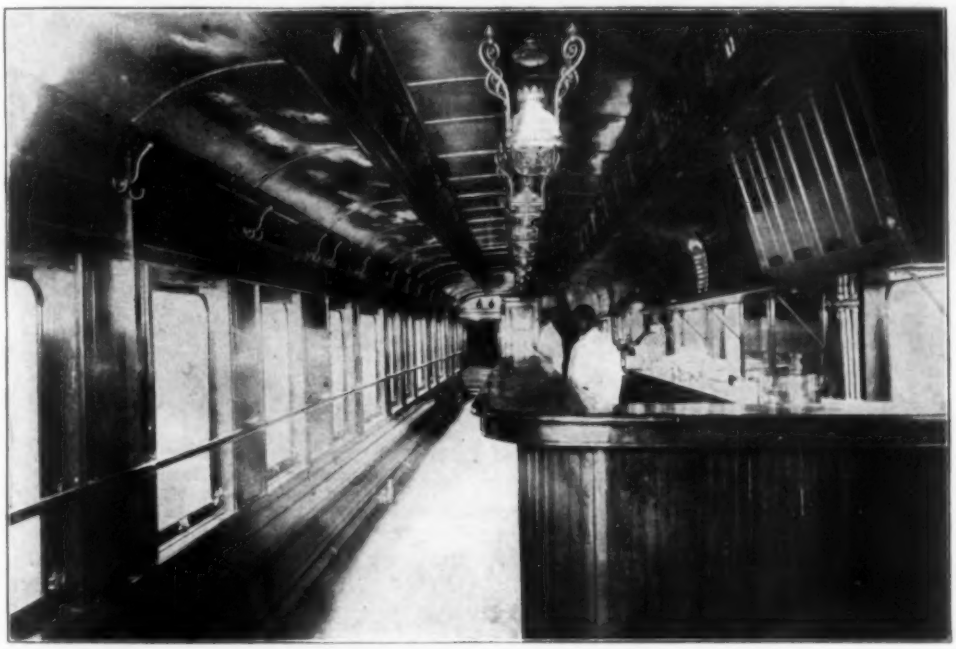
MOST ENORMOUS SCALES EVER USED—WEIGHED THE SUN'S CORONA.

Would you believe that 25,000,000 tons or 50,000,000,000 pounds could be a light weight for anything? Well, it is, or at least so declares the great Swedish astronomer, Professor August Svante Arrhenius, who has recently weighed the sun's corona, or the luminous field surrounding the sun, and who declares himself surprised that the weight is no greater. Professor Arrhenius made the atmosphere, the temperature and the telescope his scales and a mind long trained for solving solar problems did the rest.

Professor Arrhenius has settled several other light problems which had long puzzled astronomers.

Lunch Counter Car a Great Hit

Passengers on the Pere Marquette trains between Chicago and Michigan resorts have enjoyed a novel and happy feature of railway service the past summer. At the end of the week many business men rush from their offices just in time to catch the noon train and having no time for lunch before leaving the city. To meet the requirements of these hungry patrons would have necessitated the running of several dining cars to each train had not Mr. H. F. Moeller, general passenger agent at Detroit, evolved the brilliant idea of fitting up a lunch car which would accommodate a goodly number quickly, easily and at popular prices.



A Lunch Counter Car

An old parlor car was used for the purpose and a counter 3 feet 9 inches high, 16 inches wide and 42½ feet long with extensions at the ends running to the side wall was built in it. This counter is of pine, stained and finished to match the car, and has a walnut top. At each end of the counter 6 feet of space is left and 3½ feet at the side. Behind the counter along the wall were built lockers, cupboards and shelving with steam heated tea and coffee urns located centrally and overhead water-tanks at each end of the shelving. Under the counter are sinks with hot and cold water. Sixty people can stand at the counter, while the car will hold from 150 to 200 persons. There are no stools and no one is allowed to loiter. The platforms of the car are protected by railings and it can only be entered from other cars.

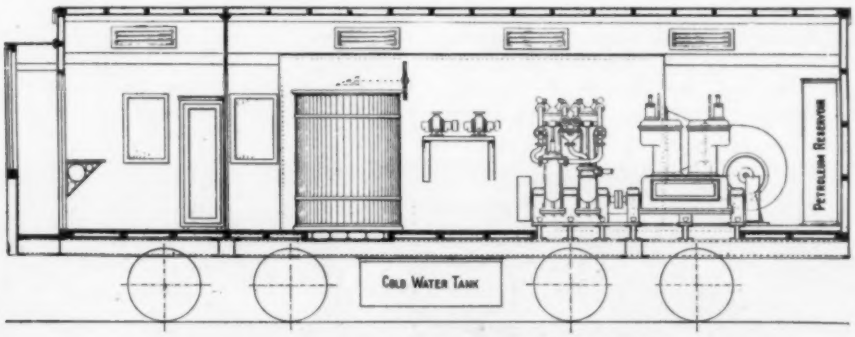
Anything common to other lunch counters may be had on the car; doughnuts, pie, sandwiches, ice cream, lemonade, milk, coffee, etc., and each article is listed at 10 cents.

To obtain the same heating value from wood and coal it takes two and one-half times as much wood in weight for each square foot of grate surface as it does of coal. In other words, the heating value of one pound of coal is equal to that of two and one-half pounds of pine wood.

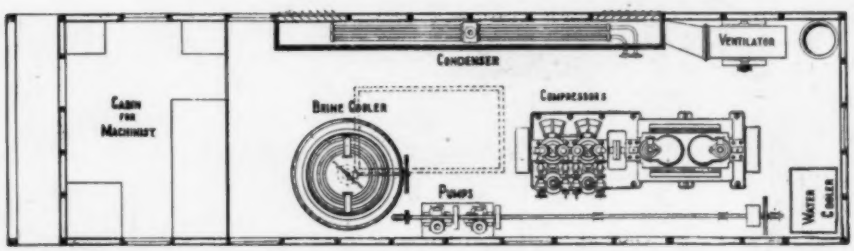
A trolley dining car is a new institution on the Aurora, Elgin and Chicago third-rail interurban line.

COLD STORAGE PLANT ON RAILS.

A portable cold storage plant is in operation on the Trans-Siberian railroad. From the first impression of ice and cold that usually attaches to the very word "Siberia," anything to produce artificial cold would seem superfluous. Nor was the new method a war necessity, but rather a plain business proposition to transport butter, eggs, poultry and other perishables over the thousands of miles which separate the termini of this road.



Side Elevation Refrigerating Car



Plan of Refrigerating Car

The system is comparatively simple. The cooling plant occupies one car from which the cold brine is pumped through connecting pipes to the cars immediately ahead and behind. The plant, which is operated by a gas engine, is not unlike plants for similar purposes employed in cold storage warehouses. The machinery is kept in constant operation during the trip, maintaining a temperature in all the cars supplied with the service at from 35½ to 39 degrees F. The ventilator is run only when the train stops and is for the purpose of cooling the condenser. A sleeping compartment is partitioned off at one end of the car where the two men in charge sleep. Ice and Refrigeration says: "As the cars used for carrying the butter were on the ordinary freight car pattern, with doors on the sides, the brine pipe was necessarily placed beneath the roofs. The cars are insulated with double boards and paper between, in connection with mineral wool. The doors are not opened from the time of loading until the end of the trip."

GOVERNMENT TRIES NEW SYSTEM OF WIRELESS TELEGRAPHY.

The first of a series of experiments with the American system of wireless telegraphy was made on the United States cruiser "Topeka" a few days ago, when it carried the delegates to the American Institute of Electrical Engineers up the Hudson river. The instruments for the system were invented by Professor Fessenden, of Washington, and naval officers believe the system is superior to that now in use on American war ships. The "Topeka" was equipped with instruments and wireless stations were established at the navy yard and Navesink Highlands, N. J. The "Topeka" has been specially detailed to conduct these tests and will make a long-distance test of the apparatus soon.

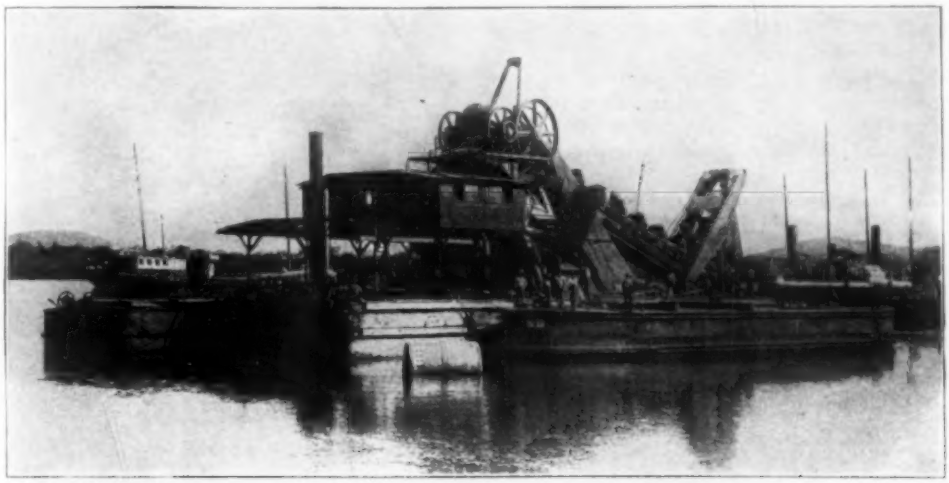
Preparatory Work on the Panama Canal

The Boneyard of France to be Reclaimed--Will Renew Life of American Commerce and Industries--Expect to Make Health Resort of a Death Bog

The great engineering feats of a nation are the athletics by which she renews and develops her strength. On such a course of training, which will probably cover a decade, the United States has just entered, the seat of action being the little isthmus of Panama.

The first step was the summarizing of the conditions, chiefly climatic, to be dealt with, and for this purpose William Bartley Parsons, one of our greatest engineers, made a thorough inspection of the canal zone. John Findley Wallace is to have the active superintendence of construction. The second step, and this too is now under way, comprises the specifications and plans for the construction of the big canal, beginning with the smallest appliance required and ending with the completed channel which at the spot where it severs two continents will also unite two mighty oceans and will divert the accustomed courses of the fleets of every nation.

The canal zone in its present state is little more than a graveyard of French ambitions. Millions of dollars of the wealth of that nation are buried there and the graves of many of her most promising manhood tell better than words can how great was the price of her failure. Altogether, France expended $20,000,000 in machinery and appliances for digging the canal. There are 2,431 buildings on the isthmus but these would not house all the machinery sent there at the time. Many of these buildings were hospitals and executive quarters and will be used again by American engineers and officials, but of the machinery, that which can be used will not exceed in value $2,000,000; the rest is a total loss to France. This is due partly to the fact that the machinery is now out-of-date, but aside from that, France purchased lavishly—extravagantly—machinery which was already out-of-date and which was not sufficiently powerful to perform the work. But the greatest cause of the deterioration has been the climate. Iron and steel, unless the most careful precautions are taken, are no more proof against the hot, humid atmosphere of the isthmus than if they were the frailest of substances. With the famous Culebra cut, France abandoned miles on miles of steel rails piled to a height of six feet; numerous rows of Belgian locomotives, too small for their purpose; acres of land set apart only as yards for hundreds of car wheels, huge buckets, scoops, engines, dredges and



Old Dredges at the Pacific Terminus of the Panama Canal

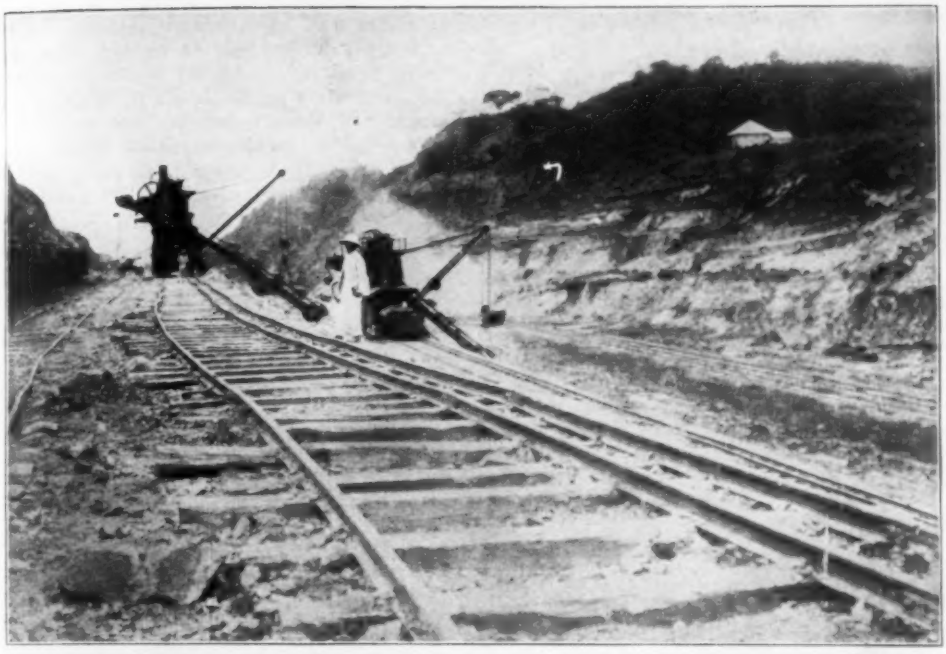
appliances of every nature and description all subject to a common fate and few which will ever serve their original purpose. Many of these heavy articles are buried from five to seventeen feet in the soft silty soil in which they had sunk deeper every day. If unearthed, one might cut their outer surfaces into small pieces like bits of rubber or cork. Some of the costly houses on the isthmus are built on foundations of $60,000 worth of machinery! Stable foundations for buildings are hard to get and what more natural than that the machinery strewn everywhere should be put to the only purpose it could serve? The moisture coats every bit of exposed metal deep with rust. Wherever a bit of earth is overturned or an excavation is made a white mist rises from the soil—a mist which bred disease and dealt death in the camps of the French and also wrought ruin to their costly equipment.

A striking exception to this general ruin is one of the big machine shops found hidden away in the brush near Bas Matachin. When the place was cleared sufficiently to allow an investigation it was found that the shop was complete and well equipped. It consisted of a machine shop, boiler shop, blacksmith shop, locomotive erecting shop, planing mill, car repair shop and foundry. The machinery and material in this instance, after having been stored away for more than 20 years, were still in average good condition and in the latter part of July the shop was in working order and the wheels began to roll.

Machinery and material well housed in good shops are, of course, better protected from the elements than are huge derricks, piles of rails, scoops, dredges, locomotives, etc., for which no proper storage could be provided because of the lack of lumber. Twenty years in the open air during all kinds of weather in any climate would have its effect on most machinery. The lack of lumber, the engineers declare, is their greatest handicap in the canal district. Everything else is plentiful, but lumber is hard to get at any price.

The methods of the United States will in nowise resemble those of France. The most startling change projected will be the transforming of this wild, enervating death bog into a habitable country which for several months of the year will be a popular health resort. Two great sanitary innovations

Present Appearance of the Famous Culebra Cut



Excavating Machinery and Old Railways on the Route of the Canal

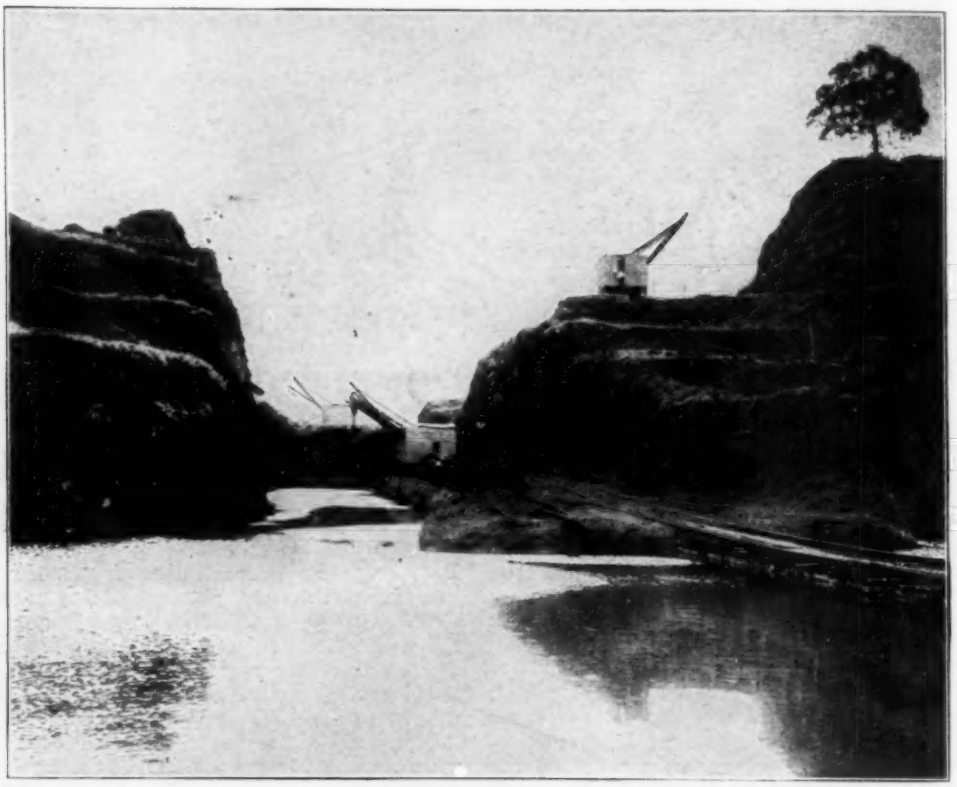
will accomplish this result, it is believed. Such an elaborate and carefully planned system of sewers will be laid as no city of our New World can boast, and also miles on miles of iron piping for carrying an abundant water supply. On these matters more than on anything else depends the success of the Panama canal. Add to this an active war for the extermination of the mosquito which will be waged at any cost. It is now established that the human body is infected with yellow fever only through mosquito bites and this fact alone makes the mosquito war important. The governor-general of the canal zone has called on the canal commission for 100,000 yards of galvanized steel wire gauze, not coarser than 17 meshes to the square inch, to be used as a protection against the mosquitoes. The De Lesseps houses at Cristobal will require 2,000 yards, 20,000 yards will be used to enclose hospitals and 75,000 yards for houses along the canal zone. Some of the swamps, which are breeding places of the insects, will be drained, others will be treated with chemicals and in still other localiites the water level will be raised by the Bohio dam. Numerous new electrical devices will also be experimented with.

The most pronounced marks of modern methods will be found in the fact that wherever feasible and practicable electrical machinery will be used. Compressed air and steam will be employed to an extent but the electrical devices will far outnumber these. Fully a year's time will be required for selecting and designing the machinery to be used. This work will be so complete that the whole force on the canal can work independent of the rest of the world for a number of years. Numerous repair shops will be established, equipped in every particular. Duplicate parts of much of the machinery will be provided and in many instances where the wear and strain are great the entire machine will be sent in duplicate. Plants where the engineering corps can forge parts will also be installed, so that no delay can possibly occur in the work which at best will cover a number of years. The whole outfit will be figured out accurately before it is shipped. Fuel will be one of the prime factors in determining the nature of the machinery in every case. Wood is out of the question as an exclusive power-producing fuel; coal is too high-priced in Panama and water-power is to no great degree available. Liquid fuel, it is estimated, will

be the cheapest and best, it being possible to deliver Texas oil at the isthmus at about a dollar a barrel.

The old French dredges and steam shovels will be used for secondary work, the new dredges and shovels will be twice as large as the old ones. Cable ways extending from steel towers will stretch across the canal at frequent intervals. These cables will be wonderful affairs irrespective of anything else. The motor that operates the hoist will convey 90 cubic feet of excavated material at the rate of 1,000 feet per minute.

Roughly estimated, there are 45,000,000 cubic yards of material to be excavated. Steam dredges and shovels by dozens, and steam and electric derricks and cranes will be employed. Solid rock will be cut through by means of compressed air and electric drills, and electric batteries will set off dynamite cartridges for exploding rock. Special processes for rendering all the metal



Old Abandoned Derricks on the Panama Canal

be located on a platform on one of the towers, and ofttimes the man who operates the dump will be a quarter of a mile away from the excavating place. The hoist can be operated to fulfill any need. It can be elevated to any height desired and run to any part of the line wished. The whole corps will be kept in touch by means of electric signals and telephonic connections between the entire system of cables will be established. The skip on most of the cables will

parts of this vast amount of machinery rust-proof and moisture-proof will be employed. In such a climate the electrical machinery has proven more serviceable than steam and it is believed that electrical markets all over the country will receive a great stimulus.

The time it will require to finish the canal is estimated at from six to twelve years, but these estimates are uncertain. John Findley Wallace says it depends not on the amount of material to be excavated, but on

the amount of work men can do in that climate. Negroes will be the chief laborers, and fully 20,000 will be required whereas there are now about 1,000 available. The laborers will be clad in the fewest garments consistent with decency and even then many of them will die of heat and exhaustion. So far as cost is concerned the country is assuming a burden which will not, for a generation at least, be self-sustaining though many indirect profits will accrue. Most of the estimates place the total cost at approximately $200,000,000, but no one counts the cost and no one thinks of failure. In the next few years this great project may bring financial wreck to many; Panama may be the last resting place of some of the brightest and bravest of our land and many anxious eyes will be turned thither for long days and nights, but all these are for the country's good. Panama will be a school where many valuable lessons will be learned and undoubtedly many valuable inventions be given to the world. The canal will be an advertisement for American machinery and South America, that Eldorado of the manufacturer, will be affected. The saving in the route from New York to Australia and eastern Asia will be so great that whereas the European countries now have the advantage over us, we will then have the advantage. But greater than all these financial benefits, it is conceded, is the sentimental aspect of the case. The two shores of our broad land will be united by a direct waterway, and in times of war the advantage is obvious. In fact, it was the dashing trip made by the "Oregon" during the war with Spain which made the need of a shorter water route so apparent. These, rather than any pecuniary considerations, are the mighty issues and near interests that have inspired the American people to take up with glad hearts the burden of the Panama canal.

Motor Boats Race Across English Channel

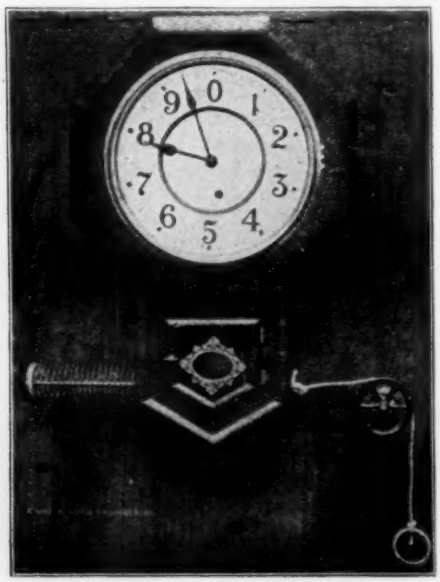
The "Mercedes IV" Under Full Headway

Motor boat racing is quite the fad now on the other side, and is already dividing honors with the automobile contests. On August 8 there was a spirited race across the English Channel, which was won by the "Mercedes IV." This boat made the trip from Calais to Dover, a distance of 22 nautical miles, in one hour, seven and two-fifths seconds, a record never beaten but once, and that was by the 9,000-horsepower turbine steamer "Queen." The "Mercedes IV." has a 90-horsepower Mercedes motor and the machinery was protected from splashing water. She carried a crew of three.

A TEN-HOUR CLOCK.

Labor-Saving Device for Computing Time

This 10-hour clock saves time and labor in computing the time of the employes in a Philadelphia factory. It was made from an ordinary time-keeper, the only difference being the new dial, which was painted on white paper and pasted over the one already there, and the year ratio between the



Ten-Hour Clock

hour and minute hands changed from 12 to 10. The clock then read in hours and tenths of hours. When work starts in the morning (in this shop it is 7 o'clock) both hands point straight up at "0." When the whistle blows the clock is started by pulling on the rope, shown in the cut. At noon, when the whistle blows, the clock is stopped with the hands pointing at 5 o'clock.

The special function is the ease with which the time spent on any job can be figured. Railway and Locomotive Engineering says:

"Under the time-keeping system employed the men are instructed to enter on their time cards the number past which the short hand stands, and to the right of this, the number past which the long hand stands. These numbers, side by side, are entered on a time card when a job is begun, and immediately above them two other numbers are placed when the job is finished. For example, a job is begun at 8:15 a. m. The time entered as shown by the ten hour clock is 1, 2, and if the job be completed at 3:45 p. m. the time as shown by the clock is 8, 0. The difference between these is 6, 8 or 6 hours and eight-tenths, or 6.8 hours. This time paid for at 27½ cents per hour, gives the simple operation in multiplication 6.8×.275=$1.87.

"The clock can be used as it stands for any length of hours or length of shifts. It is possible to arrange the starting and stopping mechanism of the clock so that the act of blowing whistle will start and stop the clock. The use of this device simplifies the time-keeper's work and eliminates much of the liability to error which exists with methods usually employed."

HOW MEXICANS PROSPECT FOR WATER.

In the semi-arid regions of northern Mexico and the southwestern part of the United States the hunt for water is carried on with great perseverence and varying success, says Modern Mexico. The "vaqueros" and "pastores" (cowboys and shepherds) of Sonora, Chihuahua and Coahuila have certain tests which they claim are even more certain than the witch hazel switch of the water witch. The following are some of them: Where it is suspected that water may be found in a well of reasonable depth, extend a sheep's pelt with the wool up. In the middle place a fresh egg. Cover by an earthen jar glazed inside when the earth is perfectly dry and the day warm, clear and without wind. At sunrise, on the next day, lift the jar, and if the egg and the wool near it are covered with dew, water will be found at a slight depth. If the egg is dry and the wool damp, water will be found at a greater depth, but if there is no dew either on the egg or the wool there is no water to be found in that vicinity. Another receipt is: Grind 60 grains of quicklime and mix it with an equal quantity of paris green and sulphur. Put the mixture in a new jar with twenty grams of unwashed wool. The mouth of the jar should be sealed with an earthenware stopper of the same material as the jar itself. Then weigh it, and when the atmosphere is perfectly dry bury it about eight inches below the surface of the ground and cover it up, beating down the earth. Dig up the jar 24 hours afterwards and weigh it. If the weight has increased in the meantime water may be found by digging, but if it weighs less there is no water in the vicinity.

Where Warring Nations Meet on Neutral Ground

Where Russian and Japanese Officers Meet Daily and Salute.

Not far from Newchwang and yet located on the neutral ground of Northern China is a station where Russian and Japanese officers meet daily and salute each other with cold, contemptuous civility. The place, known as Shan-hai-kwan, is one of the railway stations where every nation keeps a force large enough to guard its interests and this atmosphere of internationalism is enough to hold the bitterest foes subdued. Chinese military police, creatures who resemble withered hags, keep order in the place. In the illustration the Chinese wall is shown in the distance on the mountain. In Shan-hai-kwan the Japanese and Russian railway officials try to outdo each other in the thoroughness with which they do their work, look after baggage, travelers, etc. The situation is most unique, for doubtless a murderous hate lurks in the hearts of natives of the opposed nations as they meet day after day.

CHICAGO'S WATER WASTE IS 4,000,000,000 GALLONS ANNUALLY.

Recent investigation has revealed the fact that Chicago loses $390,000 annually in water waste! This means that a great percent of the "pumped" water slips back into Lake Michigan and never reaches the water mains of Chicago.

Engineers declare that all pumping stations lose about three per cent of the total amount which is assumed to be pumped, but by the figures recently given out Chicago is burning tons upon tons of coal uselessly and her citizens are not enjoying the water supply they should have.

To leaking pistons in the pumping engines is ascribed this annual 4,000,000,000-gallon loss of water. In one station the proportion lost was 10 per cent; at this ratio in all the stations it would amount to 13,000,000,000 gallons yearly, but it is not believed to be so great at other stations.

The pitometers used to detect the amount of waste are rarely accurate, city engineers say, and any figures gained in this way cannot be depended upon.

POUNDING THE SOLID CHOKE.

How the New Boy in the Flour Mill is Initiated

Every trade has its time-honored jokes which, year after year, are played upon the ever new crop of beginners. This one is a flour mill story contributed to the American Miller:

Being behind on orders we ran 15 hours, then 18. Orders continued to come until we were compelled to run day and night.

"Pound Her, Bill."

This caused the writer to begin his day at noon and end it at midnight, when his second would relieve him.

The best help is generally given the second, while the head miller must get along with any old thing. Following this rule the sweeper, who for the present I will call Bill, was assigned to me as oiler and sweeper. Now Bill—, but I will not try to describe him beyond saying that he was a wild and woolly sort of fellow; a big duffer, but harmless.

One night about 10 o'clock I was going over the mill examining the stock as usual. This time Bill went with me. It seemed strange to him that I must look into almost every spout. We were in the basement. Bill thought I was looking for a choke-up and wanted to assist me by telling me where it was.

"Never mind, Bill, I'll find it," said I, "and when I do it will be a bad one."

Going up to the next floor I shouted: "Come, Bill! Come on, quick!"

Well, Bill did not see the stair steps at all. He grabbed the mallet on the run.

"Here it is," I said; "pound this spout till I tell you to quit. It's choked solid."

I went up to the next floor and stopped. Well, I laughed until I almost went straight up. I went back to see how Bill was getting along. "Pound her, Bill. She's solid," I said.

I stepped into the dark, where the rest of the boys were standing watching Bill pound the 4x4 brace till he wore out one mallet. He sailed up to the next floor after another mallet and pounded the 4x4 until I went to him and said: "All right, Bill, she's O. K. Come now, let us go down to the boiler room and talk about the choke."

Laugh? Well, I guess yes. I laughed more that night than ever since. Bill did not know till the next day that the spout was really solid. There is a bruised spot on that 4x4 yet.

NO PLUSH CAR SEATS IN KENTUCKY.

It has remained for the Kentucky state board of health to take the first step against the use of plush car seats which collect and hold disease germs until the next passenger comes along to receive them into his system. The board will indict every railway official in the state whom it can reach who is responsible for the use of seats upholstered with heavy plush.

Leather or cane for both sleepers and day coaches are the substitutes the board will permit, and of the two, cane is preferable, for the leather seats are hot and uncomfortable. Linen makes a good seat covering, as it can be removed and laundered frequently. The effects of this initiative move may extend to other states until all our railway systems will have sanitary car seats.

An important step toward uniting the ice-bound country of Alaska with the outer world has lately been completed: the new government cable connecting that territory with American lines having been spliced by the cable ship "Burnside" in Puget Sound.

High Bridge at St. Paul Wrecked

"It Reaches a Height of 200 Feet."

The terrific cyclone which swept down the Mississippi valley a few weeks ago and did more than a million dollars' damage in the Twin Cities numbered among its playthings the huge structure known throughout the Northwest as the High Bridge. This bridge which spans the Mississippi at St. Paul is famous for the same thing that high bridges throughout the world are noted for—a jumping-off place.

The bridge which has a total length of 2,770 feet starts from the west bank of the river at an elevation of 90 feet above low water and ascends with a grade of 4 per cent until on the opposite shore it reaches a height of 200 feet. It has a 24-foot roadway and two 8-foot sidewalks and was built in 1889 at a cost of $479,878. The cyclone carried away two 60-foot plate girder spans, one 170-foot span, a trestle tower carrying a 50-foot span, and one 250-foot span. Iron was twisted in all shapes and 2-inch bolts were broken. Altogether 500 tons of iron fell, 267 tons lodging in the river.

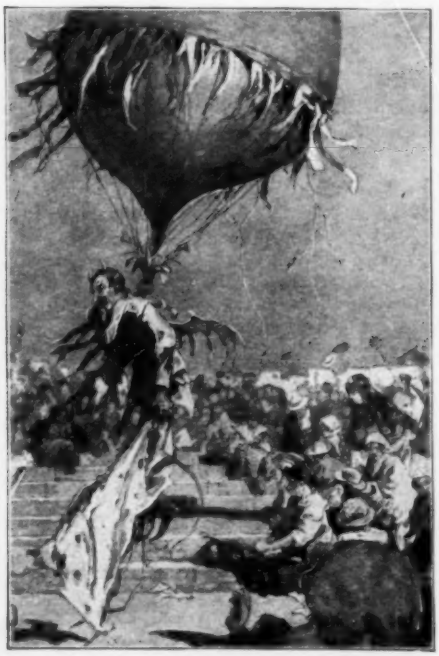
The wreckage is being cleared away and the bridge will be reconstructed. L. W. Rundlett, Commissioner of Public Works, St. Paul, kindly furnished us with the photograph of the bridge and the facts.

CITY WATER WORKS RUN BY ALCOHOL MOTOR.

At Matanzas, a Cuban city of 40,000 inhabitants, the city water works are run by an alcohol motor pump of German manufacture, reports U. S. Minister Squiers at Habana, Cuba. The installation cost $6,000, and the 45-horsepower motor pump is operated at a fuel cost of $4 per 10-hour day and pumps 1,000,000 gallons of water.

OUTWITTING SATAN

Many of us might have reason to be thankful could we rid ourselves of the attentions of His Satanic Majesty so easily



Rid of the Devil for Another Year.

as do the peasants of Val di Rose. These superstitious people are troubled by the arch-fiend but once a year, and that occasion is always followed by great merry-making and rejoicing.

Every year on the first day of August all the people of Val di Rose gather in a great square, which is the public threshing floor, also. The ludicrous ceremony which then occurs is presided over by the most intellectual man in the community. With a solemnity, such as graces all acts of mighty import, this man attaches a very realistic puppet representing the devil to a small fire balloon, which he then liberates. And all the people rejoice, for they believe that their dreams will be peaceful and their vintage uninjured for another year.

RAIN-PROOF HATS.

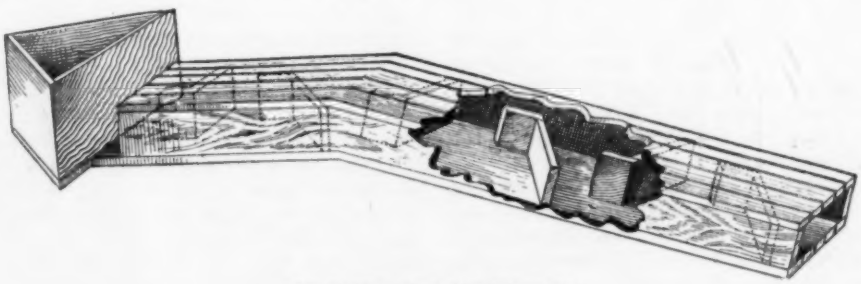
Rrain-proof hats, which can be worn in the heaviest downpour and yet retain all their delicate tintings, exquisite style and original shapes unimpaired, is the latest Parisian fad. The hats are made of celluloid especially prepared for the purpose so that it can be woven into imitations of the finest straw. It is also modeled into flowers for trimming the hats. The hats are beautiful, for the celluloid is susceptible to the most delicate tints. So long as the hats are a fad they will meet with feminine favor, but after that they will spoil the necessities for new bonnets too often to suit most women.

FISH LADDERS FOR MINNESOTA DAMS.

The Fish Commissioners of Minnesota have ordered fish ladders placed on every dam in the state. These ladders must be three feet in length for each foot of height.

The crib or bulkhead is constructed of oak, using 6x6 material and the corners being mitred and bolted. It is filled with rock for anchorage. The top of the crib stands out of the water about a foot higher than the main chute, which extends from the crib to the water below the dam.

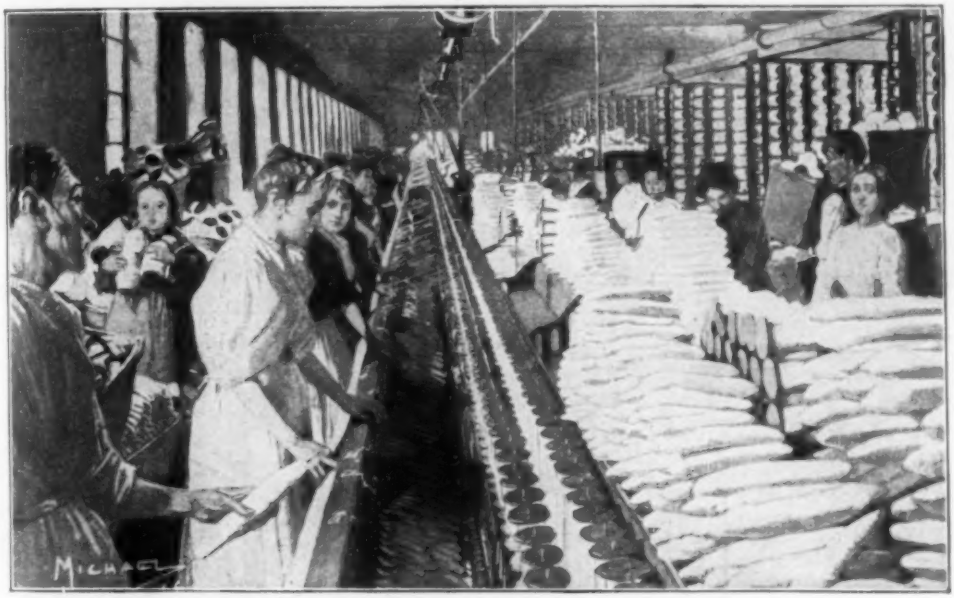
The chute is constructed of 2-inch material. It extends to within two feet of the bottom of the river and into the pool below the dam. It is placed in the channel of the stream, and when the greatest depth of water is found the chute is supported from the bottom of the stream by "horses" or similar supports.



Fish Ladder Adopted in Minnesota.

England Suffers From the Cotton Famine

England's greatest industry is the cotton industry and in certain localities whole towns are given up to the huge mills where every man, woman and child earns its daily bread, often whole families being employed. The world's cotton output has not kept pace with its population and now there is a shortage of cotton and the poor people of Lancashire are working short hours, barely earning enough to sustain life. The short time, however, was necessary to keep the price of cotton from rising and thus bringing on a greater evil, financial panic. The crisis is said to be the severest since the cotton famine during the Civil War in this country.



Typical Scene in English Cotton Mill.

England hopes, by furthering in every way possible, the cultivation of cotton in her African colonies to be able to meet such conditions in the future. How much the welfare of her people depend upon it is apparent at a glance into one of her busy cotton mills, teeming with life and labor. The winding frames with their innumerable spindles and bobbins of fleecy cotton and the never ceasing whirr of the winding is especially interesting. The faces of the employes form an unpleasing contrast to those found in our own busy factories. Where our laborers are bright with interest and many tokens of active intellect, these have dull, heavy countenances which seem as though they could look no farther than each day's grinding round in the cotton mill.

AMERICANS DRINK 910,000,000 GLASSES OF SODA WATER.

The soda water season is closing. A simple statement, but few know all that it means, or how great a commercial feature the soda water season is. In the United States alone, says the Soda Fountain, 75,000 merchants sell soda water, averaging sales of $730 a year, or a total of $54,750,000 per annum. The average price of drinks is six cents, giving the number of drinks as 910,000,000. Could the glasses required to serve this many drinks be placed side by side they would reach to within a day's travel of once around the world. These figures do not include pop, ginger ale, root beer, etc., but only sales made at the fountain.

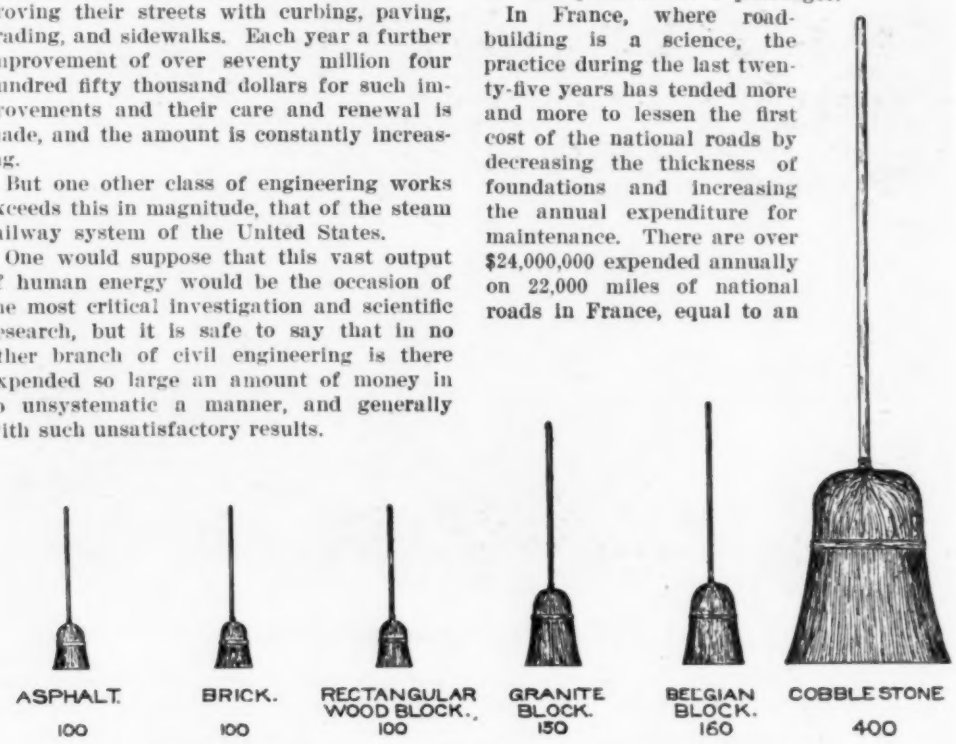
The Street Paving Problem

[Extracted from the Report of John W. Alvord, Chicago.]

At the beginning of the 20th century 24,000,000 of the population of the United States living in cities of 8,000 and over had invested approximately $850,000,000 in improving their streets with curbing, paving, grading, and sidewalks. Each year a further improvement of over seventy million four hundred fifty thousand dollars for such improvements and their care and renewal is made, and the amount is constantly increasing.

But one other class of engineering works exceeds this in magnitude, that of the steam railway system of the United States.

One would suppose that this vast output of human energy would be the occasion of the most critical investigation and scientific research, but it is safe to say that in no other branch of civil engineering is there expended so large an amount of money in so unsystematic a manner, and generally with such unsatisfactory results.



Showing Relative Amounts of Labor Necessary to Clean Various Pavements

Pavements are primarily designed to accommodate travel, but scarcely any one in this country thinks of investigating the travel of a city systematically and thoroughly before proceeding to lay down pavements.

Pavements have been a necessity of civilization since Rome was mistress of the world, but cities are still experimenting with the subject without general and well-defined policies. Community after community repeats the fundamental experiments, and copies without reflection or study what they see being done elsewhere.

The railways of the country know to a penny the cost in life service and the comparative utility of every bolt and scrap of iron that enters into their composition. They can tell you to several places of decimals the cost of moving a ton-mile of freight and the transportation of a passenger.

In France, where road-building is a science, the practice during the last twenty-five years has tended more and more to lessen the first cost of the national roads by decreasing the thickness of foundations and increasing the annual expenditure for maintenance. There are over $24,000,000 expended annually on 22,000 miles of national roads in France, equal to an average of $225.00 per mile per annum for repairs alone on country roads.

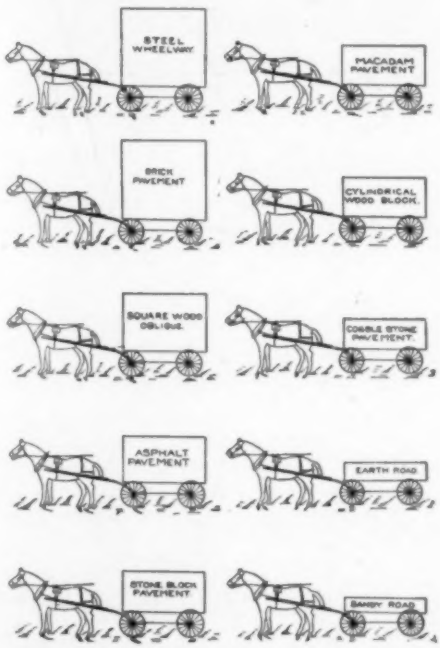
A report from 135 American cities from 1890 to 1901 show that of new pavements the following percentages were laid:

Asphalt	33 per cent
Brick	25 per cent
Macadam	23 per cent
Granite	8 per cent
Wood	7 per cent
Miscellaneous	4 per cent

Residence streets should not be paved wider than 18 feet, which allows three vehicles to stand side by side, and turning points can be established in the middle of long blocks, if necessary. The tonnage of the traffic in some of the business portions of Chicago rises to 15,000 tons per day, and is

accommodated in some places on a 30-foot roadway, but there is hardly a residence street in which the traffic exceeds ten tons in this same time, and yet with this tremendous difference in traffic, we find but little allowance for difference of width.

Asphalt itself is a variable material, the only reliable test of which is its action in the pavement. Such pavements have frequenty failed, but it is to be remembered that the industry is new and has been rapidly developed in less than thirty years to the point where there are now about 2,000 miles of street, representing an investment of over $100,000,000, in this country alone. The wearing surface of asphalt pavement is composed of ninety per cent of sand or mineral matter, the asphalt being the cement that binds it into a tenacious and elastic coating. If, for any reason, such as improper preparation, age, or volatilization, the cementing quality of the asphalt disappears, the pavement disintegrates, cracks, and is rapidly worn or broken down. The general tendency of asphalt pavement to decay will be indicated by its loss of elasticity, during sudden changes of temperature, cracks forming during cold weather, and particularly during extreme drops in the temperature.



Comparative Loads one Horse Can Draw on Different Roadways.

THE AUTO TELEGRAPH CAR.

The United States government has decided to make a practical trial of the usefulness of the automobile in modern warfare and to that end has just had constructed for the United States Signal Corps a high power motor vehicle known as an auto telegraph car and which is the only machine of its kind in the world. In this age the chief function of the Signal Corps is to erect military telegraph and telephone lines in order to keep communication open between forts or other headquarters and the forces in the field and it is in this service

"Only Machine of Its Kind in the World."

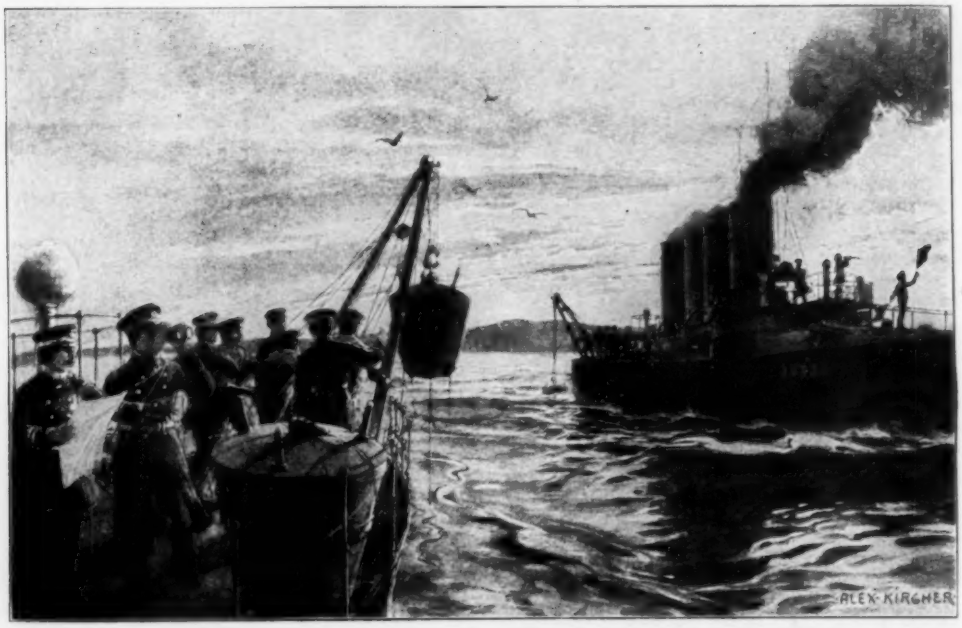
that the new auto car will be used. It is designed not only to facilitate the rapid erection of telegraph lines, but is also equipped for use as a field telegraph station.

The automobile itself is very similar to a heavy touring car of the Winton type with the exception that the ordinary style of tonneau has been replaced by a special tonneau with seats along the sides, the occupants of which face each other, and having ample storage space for instruments, and other equipment. At the sides are racks on which are carried lances or light poles for use in erecting a temporary overhead telephone or telegraph line when other supports are not available. The "flying telegraph office" is equipped with all the latest modern improvements, including "sounders," which make it possible to receive and transmit messages amid the din of battle. The regular automobile detachment comprises eight soldiers, six of which act as an armed guard for the operators.

Popular Mechanics makes a special subscription offer of five years for three dollars. Address may be changed at pleasure.

JAPANESE MINES THE TERROR OF RUSSIAN FLEETS.

The Japanese have been very daring in the matter of laying mines. Ofttimes they have watched their opportunities and done their work under the very noses of the Russian fleet at Port Arthur.



Japanese Torpedo-Boat Destroyers Laying Mines Outside Port Arthur.

One feature of this work was a most deadly explosive invented by one of their engineers. The inventor kept the nature of the explosive a profound secret, but while superintending the placing of a mine it exploded, and he was killed and the secret of his invention was lost with him, much to the regret of the Japanese.

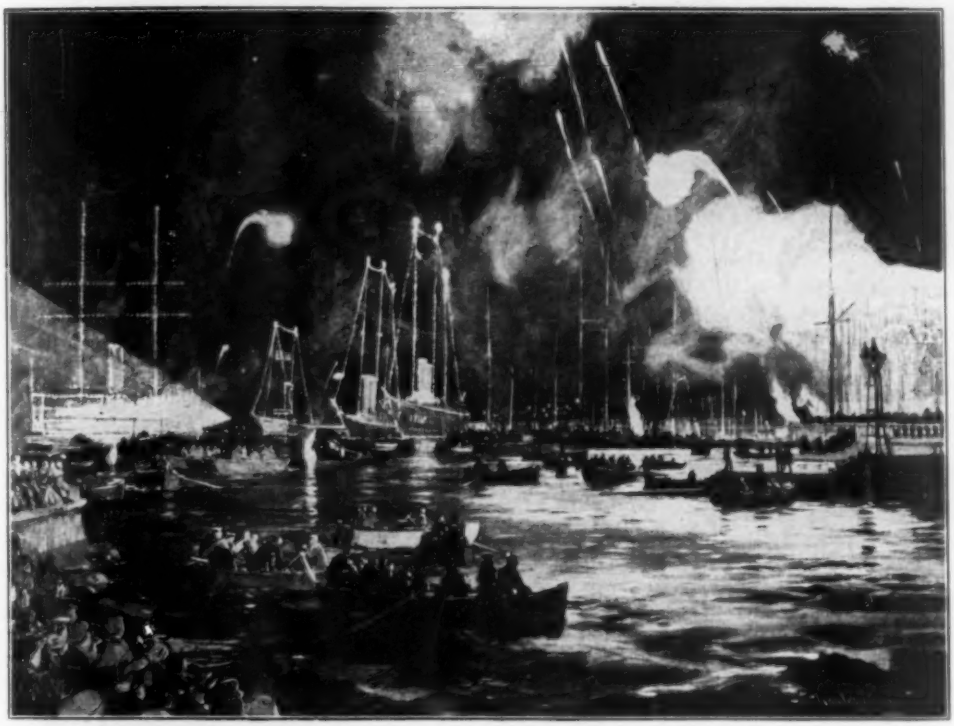
SPEED IN WARSHIPS.

Is it worth while to sacrifice any naval qualities in warships for the sake of speed? This is the question that has been agitating the minds of French naval tacticians, says the Engineer of London, and one faction declares that the consideration of speed is secondary, citing the manner in which the "Gloire" class have all beaten the "Jeanne d'Arc" (two knots swifter) on trial and how the Japanese vessels "Tokiwa" and "Asama" failed to catch the slower Russian vessels "Gromoboi" and "Rossio." The five months' service, declare the French, had lowered the 22-knot speed of the Japanese vessels to 16 knots. An investigation reveals, however, that the Japanese vessels had cylindrical boilers while the Russian vessels were equipped with watertubes in perfect condition.

The English paper in refuting the stand taken against speed as an important element, declares: "The swifter ship always has the option of battle, and that means much, if not everything in modern warfare. The swift warship or fleet cannot, of course, be in two places at once, but it can certainly compel the enemy to have ships in two or three different places at once to waylay it. In fine, it is tolerably certain to compel the enemy to divide, and thus take risks of annihilation in detail.

"Difficulties there are, and must ever be. Mostly they are inherent in warships. For instance, the ocean liner is designed to run at a high speed regularly, rarely cruising at a low rate, whereas the warship usually goes slowly, but must be able to spurt her hardest at very short notice. From this cause troubles may arise now and again, but the navy whose ships can race on occasion is the navy that must rule the sea."

Brilliant Scenes at an English Yachting Festival



"The Scene at Night Was One of Beauty Beyond Description."

The annual yachting festival held at Cowes, Isle of Wight, during August, was a most brilliant affair. The king and queen graced the occasion and the weather was beautiful, a combination of affairs calculated to rejoice the average Englishman's heart.

Among the yachts which entered the races the German emperor's "Meteor" was very conspicuous because of the poor showing it made and the "Ingomar," owned by an American, Mr. Morgan Plant, was of interest because of the splendid speed made in the race for big yachts in which it won first prize. Most of the first prizes were taken by Englishmen.

The scene at night was one of beauty beyond description. Each yacht was brilliantly illuminated with myriads of incandescent lights, which the clear waters doubled and tripled, and the fireworks displays intensified the effect.

TO REMEDY ELECTROLYSIS IN ST. PAUL.

The escaping electric current from the rails of the street car lines in St. Paul has been attacking the underground water and gas mains for some years. The city authorities have insisted that some remedy be provided. The railway company have decided to lay copper wires between the double tracks, and lead these wires back to the power station. By frequent connection of these wires to the rails it is expected the escape of stray currents into the earth will be prevented. The cost of the wire and labor of installing will be $23,000. Work will commence at once.

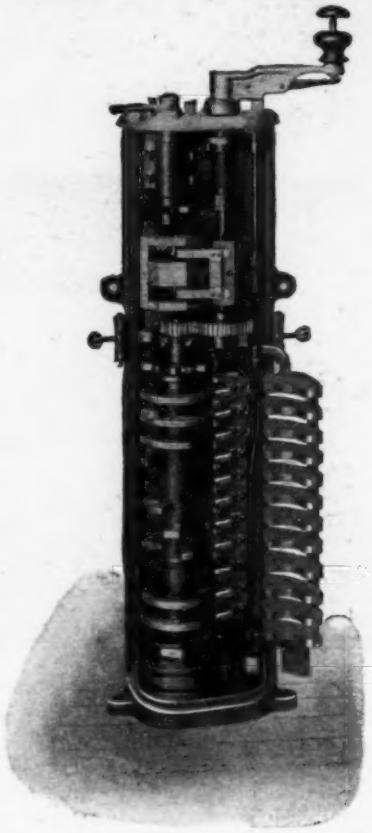
CONTROLLER ON A TROLLEY CAR.

The "Throttle" by Which the Motorman Turns on the Power

The popular idea of the controller of the electric car seems to be that it is an iron box containing a good deal of delicate mechanism which, in some incomprehensible manner, performs certain complicated functions, says the Electrical Review. Many, no doubt, think that the controller cover conceals electromagnets, gear wheels, rods, wires and other devices, all in imminent danger of flying to pieces when anything goes wrong. This is not true, for although the action of the controller may seem complicated to one who has not made a study of such devices, the mechanism of the controller is exceedingly simple. When anything happens to the controller, it is the controller itself which suffers. It is true that sometimes the motorman's clothing may be damaged under such circumstances by hot metal, but the passengers themselves, if they are where they belong, are in no danger. Every one appreciates the startling character of a brilliant electric arc suddenly appearing when and where least expected, but the electric arc is not dangerous to those who remain at a respectful distance.

The electric controller used on a street car may be compared with a water faucet, though, of course, the analogy must not be pushed too hard. Its function is to regulate the supply of current both in amount and in the way it flows through the car motors. It allows the current to flow first through a single path, and, by steps, reduces the opposition to this flow, thus allowing the current to increase. It then supplies two paths, as though two faucets were opened, and again by steps allows the current to increase through each of these paths.

For convenience in manipulation, all electrical connections, except such as are permanent, are made by the controller. Exception is made in the cases of the fuse and circuit-breaker, which are safety devices, and, for this reason, are separated from the controller and are isolated. The function of these two is to open the conducting circuit when the current flowing through the car is too great. Other than this they have no effect on the motors. An electric motor consists of two parts, each of which contains a winding of copper wire. The rotating part is called the armature, and the fixed part, the field. From each end of these two windings wires are carried to each of the car's controllers. Since there are two motors, there will thus be eight wires carried in a cable under the car floor and up through the platform floor to the controller. An additional connection



A Controller

may be made to the field winding, for the purpose of giving a greater range of speed, but this is not essential to the working of the car. Besides the car motors, there is under the car the so-called rheostat, a device for preventing the flow of excessive currents. This device is usually divided into two or three sections. When all of it is connected in the circuit, the greatest resistance is offered to the flow of current. As it is cut out by the controller, the resistance it offers decreases until it is finally all removed. Assuming two sections of the rheostat, there will then be three wires

carried from this piece of apparatus to each controller. There are two other wires, one by which connection is made to the trolley, and the other making connection through the car truck to the rails. In all, this makes thirteen wires led into each controller.

The function of the controller is merely to establish suitable electrical connections between these thirteen wires. When the controller handle is first turned, everything is connected, as we say, in series—that is, the current coming to the car from the trolley wire passes through the rheostat to the field winding of one motor, then through its armature, next to the field winding of the second motor, finally passing through its armature to the track. The next two or three moves of the controller handle merely cut out the rheostat in steps, just as though a faucet handle were given two or three turns, opening it wider to allow more water to flow. The next movement of the controller handle causes the current entering the car to pass first through the rheostat. It then has two paths by which it may reach the track—one through each motor. Further movements of the controller handle cut out the rheostat as before, leaving the two motors connected directly between the trolley and the rail by means of the wires running through the controller.

The movable part of the controller is an iron spindle, upon which is arranged a series of metallic discs insulated from the spindle. These discs are connected together in pairs, and they are partially cut away at the periphery, so that they represent a series of cams. On the back of the controller are a number of brass blocks supported on springs, which press each of them in contact with its corresponding disc whenever the projecting portion of the latter comes opposite to the contact block. To each of these blocks one of the car wires is connected. In this way the electrical connections just explained are made successively as the handle of the controller is turned. When the handle is at the off position, none of the contact blocks is touching the discs. There is, in addition, the reversing lever, which is placed in the controller box, but this is only operated when the regulating handle is thrown off, and it merely makes the necessary change in the method of connecting the motors so that the car may be run in either direction.

What happens when a controller breaks down, or, as the motorman would say, "blows out," is either that too large a current has been allowed to pass through some of the wires in the controller—a rare accident which should be prevented by the fuse; or, in throwing the controller to the off position, which should break the current, the latter has instead jumped from one contact block to another, or to the frame of the controller. This produces what is called a short-circuit—that is to say, a path offering little resistance to the flow of current from the trolley wire to the track. This arc may cause more or less damage to the wires and metal of the controller before it goes out, but the damage is usually slight and is confined to a small spot. It is to be expected that the average passenger on an electric car is startled when something goes wrong, with a bright flash and a loud report, but he is learning rapidly that this does not signify danger, and that he is safest if he sits still. On the other hand, electrical apparatus is being improved rapidly, so that such accidents are becoming rare. In some of the latest types of controlling systems the main motor current does not pass through the controllers—in fact, it at no time in its passage is above the car floor.

FIREMEN TO QUALIFY AS ENGINEERS.

Two big railway companies, the Lake Shore and the New York Central, have decided that in order to secure competent engineers and to weed out incapable firemen, they will educate their firemen in conjunction with their daily duties to become engineers. More than that, the fireman who will not take the education will lose his job.

In the first year of his service the fireman will receive a book of rules pertaining to the mechanical and fuel phases of a locomotive. If he fails to make a good grade when examined at the end of a year he will be dropped from the service. The course covers three years and a grade of 80 per cent secures a diploma as a qualified engineer. The examining board, however, require a grade of 100 per cent.

The English telegraph service, which is a branch of the postal department, had a deficit last year of $4,500,000. This is partly due, however, to extensions and maintenance of newly established lines not yet self-sustaining. Last year over 83,000,000 messages were handled.

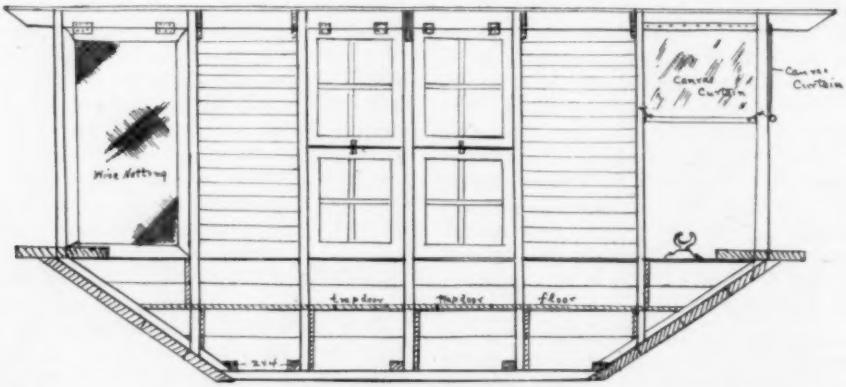
HOUSE-BOAT TRIP FROM CHICAGO TO ST. LOUIS.

Editor Popular Mechanics: I send you a rough sketch showing a longitudinal section of a house-boat in which I recently completed a trip from Chicago to St. Louis. Those of your readers who live along the Illinois or Mississippi rivers will no doubt think this a crude craft of its kind, but to the inland boys it will convey a fair idea of how to build a house-boat cheaply in which just as much fun can be had as in a more pretentious craft. This boat is 24 feet long, 6 feet wide and 10 feet high, and the lumber in it cost $60 in Chicago. The hull is built of 2x10 pine dressed, and the seams calked so that she never leaked a drop. The studding and bracing is all 2x4 except in the corners, where 4x4's were used. The cabin, 14 feet by 10 feet, had a door at each end and double windows on each side, the upper sash being hinged and the window openings are covered with wire netting on the outside, the sash swinging inwardly and hooked up to the ceiling. At the stern where we had our gasoline stove, wire netting on hinged frames with canvas curtains formed a perfect protection from flies, mosquitoes and wind. At the bow or front end, where we used our oars for propelling and guiding the boat, we had canvas curtains which could be adjusted at any height and set at an angle like regular awnings.

The hull was built deep so as to withstand any waves that we might encounter in the river from storms or passing steamers. The floor is 18 inches below the hull line, and the space under the floor is used for storing ice and supplies; trap-door affording ready access thereto.

The bunks (not shown) were the ordinary woven wire mattress frames, hinged at their inner corners to the uprights or studding and supported at their outer corners by chains, the inner ends of which were connected to staples driven in the 2x4's, so that during the day the bunks were folded back against the wall and held so by hooks, thus leaving the entire floor space of the cabin free for table and chairs. At night the table and chairs were folded and the bunks let down.

The roof was 10-ounce canvas covered with three coats of good lead paint, but a cheaper roof could have been made with matched boards covered with tarred paper. Common mosquito netting could be substituted for the wire netting. The hull and the roof are the essential features and must be tight. We used common siding for the sides and ends and did not line the cabin. An important point is to have as much "rake" as possible, thus causing the boat to ride the waves easily.



Side Elevation of House-Boat

In this boat we drifted, rowed and were towed through the Illinois and Michigan canal from Chicago to La Salle, Ill., where we ran into the Illinois river, which we traversed to Grafton, Ill. (near Alton), where we struck the "Father of Waters," who carried us along at the rate of seven miles an hour to St. Louis, the entire trip taking just three weeks. So enamored have I become of house-boat life that I shall build a larger craft, equip it with a paddle-wheel and a gasoline engine, launch it in Lake Michigan and use it for summer outings in the streams along the eastern shore of the lake.

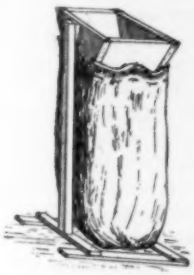
F. B.

Have you seen "Shop Notes?"

SHOP NOTES

HANDY HOME-MADE BAG-HOLDER.

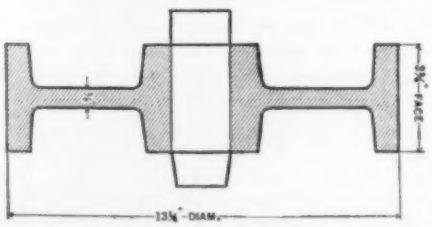
A firm standard supporting a wooden hopper of convenient size and provided with iron hooks on which to hang the bag constitutes this convenient bag-holder. Any workman, shop-keeper or farmer can build it out of a few pieces of wood with little trouble and no expense and will find it a time and temper-saving device forever afterward.



MAKING A FRICTION WHEEL PATTERN IN SHORT TIME.

A customer wanted a friction wheel and two castings made in a hurry one afternoon, says a correspondent of The Patternmaker, and the pattern was rushed out in one hour and twenty minutes by the following method:

"Planed out a piece the right thickness for web, bored a small hole through at center for divider points and struck a circle on each side to nail segments to. Sawed four segments for each side accurately to line on inner diameter and to the right bevel for draft. Sawed a hub for each side with proper draft. Sawed two sets of prints, one 2 inches in diameter, one 1¼ inches in diameter. Segments were nailed to each side of web, drag hub nailed on carefully in

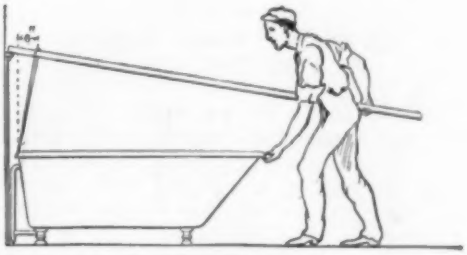


Emergency Pattern.

center, measuring from inside diameter of segments. Outside diameter of wheel was then marked from this hub center and the outside of entire wheel sawed with proper draft. A ⅜ dowel was put in center of loose hub and dowels in center of all prints and holes bored in hubs to match, so that molder could change them at foundry. Saw was in excellent order and no sandpapering was done. Putty fillets were put in, a coat of varnish was put on and the pattern sent to the foundry.

HOW ONE MAN MOVED A BATHTUB IN A TIGHT CORNER.

Disconnecting and resetting a 6-foot porcelain enameled bathtub, the foot end of which stood in a close-fitting recess for a distance of two feet, is hardly a job that any plumber would care to tackle alone, but a correspondent of the Metal Worker, Plumber and Steam Fitter tells how he did it.



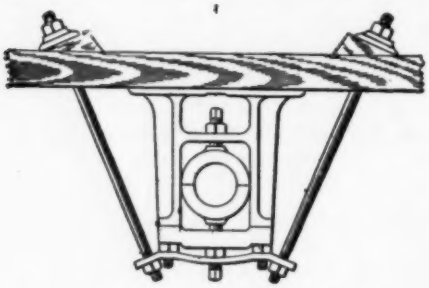
Moving a Bathtub.

A small block of wood was fastened to the cap of the wainscoting by means of brads. Bearing on this was placed one end of a 2x4-inch scantling about 10 feet long, place edgewise. A loop of sash cord was passed around the double bath bib and the scantling, while the further end of the scantling rested on the rim at the head end of the tub. Standing at the head end of the tub, and raising the end of the scantling with the right hand, the foot end of the tub was easily lifted. With the left hand lifting the rim of the tub at the head end, the tub swings clear, and may be moved to either side or endwise at will. The endwise movement is obtained by shifting the loop of rope out of the perpendicular on the scantling in either direction.

The bathtub when lifted with the rope in the position shown in the sketch will move six inches toward the plumber.

REINFORCING A SHAFT HANGER.

Irregular impulses from the engine will often cause shafting to break down, causing much damage and endangering lives. The method here shown of reinforcing the shaft hanger was used by a correspondent of the Engineer, and effectually overcame the

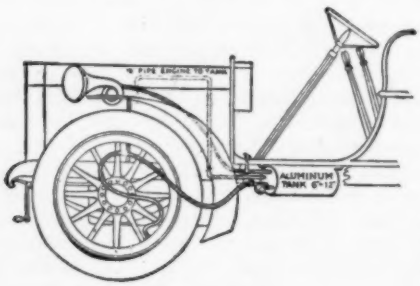


Reinforced Shaft Hanger.

trouble with a length of 4-inch shafting. In a shaft hanger the tension should all be taken by steel or wrought iron, and cast iron should be used only to give rigidity.

AN AUTOMATIC HORN BLOWER AND TIRE INFLATER.

A new device for automatically blowing automobile horns and inflating tires consists of a small aluminum tank, 6 inches in diameter and 12 inches long, which is connected with the cylinder of the gasoline motor by a pipe containing a check-valve. The opening is exceedingly small. When



Automatic Horn Blower.

an explosion takes place a minute quantity of gas finds its way into the tank, where it is kept under pressure until wanted for use. By pressing a foot button a whistle can be blown, and a hose connection is provided for inflating tires. The same outfit is used with some modifications, for sounding whistles in motor boats.

ESTIMATING THE HORSEPOWER OF STEAM ENGINES.

When steam engines were first introduced they were largely used to take the place of horses, previously employed for raising water from mines. Naturally the people would inquire, when buying an engine, what amount of work it would perform as compared with horses. The earliest engine builders found themselves very much at a loss to answer these questions. Their first business, therefore, was to ascertain how much a horse could do.

The most powerful draught horses and the best of any then known were the London brewers' horses. These, it was ascertained, were able to travel at the rate of two and a half miles per hour and work eight hours per day. The duty in this case was hoisting a load of 150 pounds out of a mine shaft by means of a cable. When a horse moves two and a half miles per hour, he travels 220 feet in a minute, and, of course, at the speed named, the 150-pound load would be raised vertically that distance. That is equal to 300 pounds lifted 110 feet per minute, or 3,000 pounds lifted 11 feet, or 33,000 pounds one foot high in one minute. That is the standard of horsepower, as we all know. It is much more, however, than the average horse can do, and therefore the engine builders were confident that the engines would take the place of fully as many horses as the horsepower would indicate that they should.

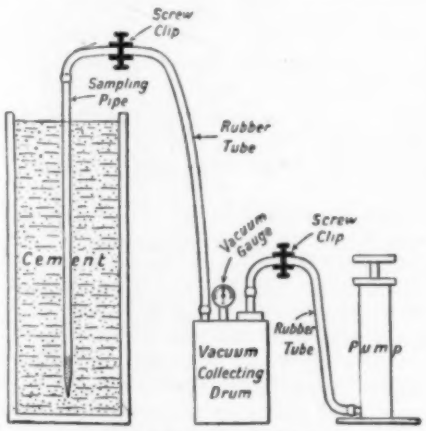
Of course, 33,000 pounds lifted 1 foot per minute is much more convenient for calculation than 150 pounds lifted 220 feet, and therefore the former has been adopted. The amount of work, or number of foot pounds, is the same in either case. A foot pound represents the amount of power required to lift one pound one foot high. To find the number of horsepower in any engine, we multiply the area of the piston by the average pressure per square inch upon the piston, multiply this result by the distance which the piston travels per minute in feet, and the result is the number of foot pounds per minute which the engine can raise. Divide by 33,000 and the result will be the number of horsepower. The number of feet per minute traveled by the piston is twice the number of strokes per minute multiplied by the length of the stroke. This gives the number of horsepower sufficiently accurate for all practical purposes.

J. M. Bulkley.

MACHINES FOR SAMPLING CEMENT.

An English device, lately patented, takes a sample of cement from any given batch with great simplicity of operation and accuracy.

The apparatus consists first of a small iron pipe some ⅝ inch in bore, with one end closed and drawn to a point. The other end is open, and to it can be attached a length of rubber tubing. The pointed end of the pipe has a number of small holes pierced in it, and to take a sample this tube is thrust into the heap of cement. It may be pushed in at any angle from vertical downwards. The india-rubber tube above referred to is connected to a drum provided with an opening covered with a screw cap, the whole being made air-tight. The apparatus is completed by means of an exhausting pump which may either be worked by hand or by a small motor. In the apparatus first tested an ordinary hand and foot pump was used. It was also connected to the drum by a length of rubber tubing. Each length of rubber tubing was provided with a screw slip, which could be



Cement Sampling Apparatus.

made to nip the tubing so tightly that no air could get past. In the tests the heap of cement was represented by a vertical box, some 9 inches square, and filled with cement to a depth of nearly 6 feet. This is about the limit of depth to which the apparatus may be applied with success, but a depth of 6 feet is ample for all practical purposes.

In sampling the iron pipe was plunged nearly to the bottom of the box of cement. The amount of cement which is forced through the small holes in the lower end of the pipe during this process is so small that it may be neglected. The clip on the rubber tube joining the sampling pipe with the drum was then screwed up. A man then worked the pump, and exhausted the drum until a vacuum equal to some 18 or 20 inches of mercury had been produced, when the clip on the tube between the drum and the pump was screwed up, so that any tendency to leakage through the pump valves might be counteracted. The drum had fitted to it a gauge, so that the amount of vacuum in it might be readily seen. The clip on the tube between the sampling pipe and the reservoir drum was then unscrewed, with the result that a certain amount of cement was drawn through the small holes in the sampling pipe, up through the latter, and then conveyed thence through the rubber tube to the reservoir. The whole process takes but a minute or two, and the amount drawn into the reservoir varies with the vacuum produced. In the tests several pounds of cement were drawn over each time. Several samples may be taken if desirable, and the whole operation requires but half an hour.

DRILLING HOLES IN GLASS.

One of our readers, Frank F. France, Plattville, Wis., writes: I see in your August number an article on how to bore holes in glass. Another way which I have used is to just make a pump drill, as in illustration, then lay the glass on a level table and lay a board over the glass. The board must have a hole bored just the size you want your hole in the glass; then lay the board on the glass with the hole in the board over the spot and clamp to the table so it is solid, then put a small pinch of sand in the hole in the board and drill part way on each side and you will have the hole in the glass. Remember the oak stick in the drill is almost the same size as the hole in the board. Put fresh sand in the hole frequently.

HOW TO SOFTEN FILES.

To soften small files cover them with oil and hold them over a fire until the oil blazes. As soon as the flame runs all over the file, plunge it into water.

ROPE HOISTS FOR HANDLING SHAFTING.

When lowering shafting by means of rope if it is necessary to come to a rest at any point in the proceedings there are several ways of clamping it, but some are not as safe as they may at first appear.

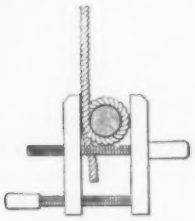


Fig. 1. Clamping a Rope Suspending a Shaft.

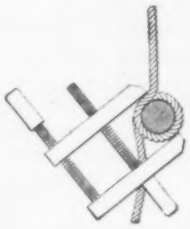


Fig. 2. The Probable Result.

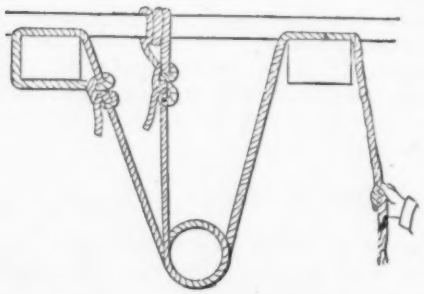


Fig. 3. Lowering With a Safety Rope Added.

Fig. 1 shows a method of clamping the rope to the shaft which is not to be depended on for the probable result is shown in Fig. 2. Against the peculiar pull made by a heavy shaft while being lowered it is to be doubted whether any wooden clamp yet devised would hold, says a correspondent of the American Machinist.

Fig. 3 shows a safe and easy method of holding the shafting at any point. If there is only one pulley on the shaft, two safety lines may be used, one at each end and the rolling hoist rope in the middle.

If the piece to be hoisted is exceptionally heavy and lacking a pulley large enough to serve as a hoist lever, any bar or piece of timber may be used as shown at Fig. 4.

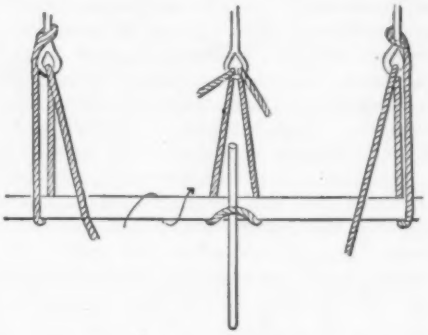


Fig. 5. One Hoist and Two Safeties.

If the center hoist and two-end safety-line way is used, with a bar or even a pulley, try to make it work centrally, as shown by Fig. 5.

Where an extra large and heavy pulley countershaft is to be hung on a very high ceiling and rolling must be resorted to, for lack of head room or suitable tackle, the inadvisable, because most hazardous, rolling from ladders can be done away with as in Fig. 6. The hangers being up, place the stripped shaft in the bearings and adjust the collars. Tie a rope's end to the pulley on the floor, pass the other end over the

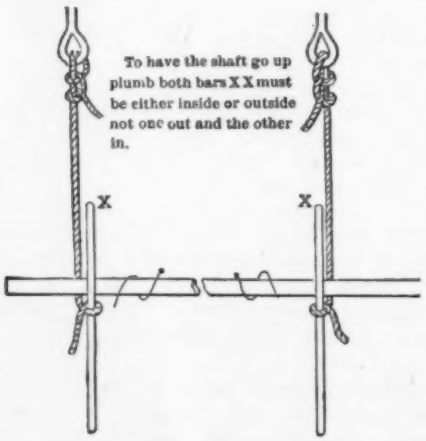


Fig. 4. Hoisting With Two Ropes.

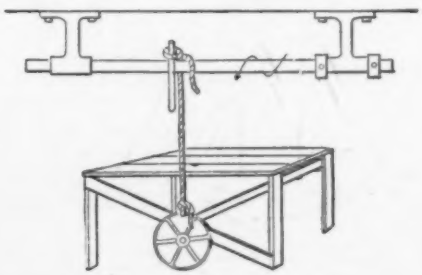


Fig. 6. Hoisting With a Scaffold.

shaft, run a bar through a bow-line in the rope and hoist the pulley to the staging from which the counter was put up. When everything is on the scaffold take the shaft out, assemble the counter and hoist it into place the rest of the way in the regular manner.

BORING HOLES IN GLASS.

Holes of any size desired may be bored in glass by the following method: Get a small 3-cornered file and grind the points from one corner and the bias from the other and set the file in a brace, such as is used in boring wood. Lay the glass in which the holes are to be bored on a smooth surface covered with a blanket and begin to bore a hole. When you have made a slight impression on the glass place a disk of putty around it and fill with water to prevent too great heating by friction. Continue boring the hole, which will be as smooth as one bored in wood with an auger. Do not press too hard on the brace while boring.

AN EXCELLENT SOLDERING SOLUTION.

For general soldering and for soldering galvanized wire points in particular, the Telephone Journal gives the following recipe:

"Take a wide necked, 6 ounce bottle, and pour in about 2 or 3 ounces of hydrochloric acid. Drop into the bottle a dozen or two small pieces of zinc, preferably granulated and wait until all ebullition ceases. In using either a solution or a stick flux, apply the heat to the middle of the joint, as the solder must run there first to obtain strength and solidity. Too much heat will anneal the wire and weaken the line. Wipe the joint free of all acid after soldering, or corrosion will follow."

HOW TO MAKE A USEFUL SOFT ALLOY.

A soft alloy which will adhere tenaciously to metal, glass or porcelain, and can also be used as a solder for articles which cannot bear a high degree of heat, is made as follows:

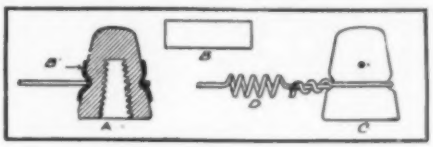
Obtain copper-dust by precipitating copper from the sulphate by means of metallic zinc. Place from 20 to 36 parts of the copper-dust (according to the hardness desired) in a porcelain-lined mortar, and mix well with some sulphuric acid of a specific gravity of 1.85. Add to this paste 70 parts of mercury, stirring constantly, and when thoroughly mixed, rinse the amalgam in warm water to remove the acid. Let cool from 10 to 12 hours, after which time it will be hard enough to scratch tin.

When ready to use it, heat to 707 degrees F. and knead in an iron mortar till plastic. It can then be spread on any surface, and when it has cooled and hardened will adhere most tenaciously.

TO STOP THE HUMMING OF WIRES.

The humming sound made by telephone lines is often very annoying and there are two easy methods of stopping it, says the American Telephone Journal.

Take a piece of rubber, B, long enough



To Keep Wires from Humming.

to go around the insulator and place it in the groove, as shown at B', Fig. A. Put on the wire and fasten in the usual manner.

Another method is shown in Fig C. Make a spiral of line wire about 2 feet long, D, and arrange it about 10 feet from the insulator. This takes the strain off the insulator during a high wind, also.

UMBRELLA JOINTS NEED OIL.

One never thinks of bestowing any especial care on his umbrella, and that is the reason the ribs break in a strong wind when the owner least expects it. The joints of an umbrella should be oiled first with coal oil or kerosene to clean off the rust, and then lubricating oil should be applied to make them work easily.

A GOOD QUICK-DRYING CARRIAGE VARNISH.

Boil together for four hours 8 pounds of fine pale gum anime, 2 gallons of clarified oil and 3½ gallons of turpentine. Strain, put into the two former pots and mix well together. It will cause the paint to dry more quickly and firmly and will enable it to take on polish quickly.

Knots and Miles.

Knots	Miles	Knots	Miles	Knots	Miles	Knots	Miles	Knots	Miles
1.00	1.1515	6.00	6.9091	11.00	12.6667	16.00	18.4242	21.00	24.1818
1.25	1.4394	6.25	7.1970	11.25	12.9545	16.25	18.7121	21.25	24.4697
1.50	1.7273	6.50	7.4848	11.50	13.2424	16.50	19.0000	21.50	24.7576
1.75	2.0152	6.75	7.7727	11.75	13.5303	16.75	19.2879	21.75	25.0455
2.00	2.3030	7.00	8.0606	12.00	13.8182	17.00	19.5758	22.00	25.3333
2.25	2.5909	7.25	8.3485	12.25	14.1061	17.25	19.8636	22.25	25.6212
2.50	2.8788	7.50	8.6364	12.50	14.3939	17.50	20.1515	22.50	25.9091
2.75	3.1667	7.75	8.9242	12.75	14.6818	17.75	20.4394	22.75	26.1970
3.00	3.4545	8.00	9.2121	13.00	14.9697	18.00	20.7273	23.00	26.4848
3.25	3.7424	8 25	9.5000	13.25	15.2576	18.25	21.0152	23.25	26.7727
3.50	4.0303	8.50	9.7879	13.50	15.5455	18.50	21.3030	23.50	27.0606
3.75	4.3182	8.75	10.0758	13.75	15.8333	18.75	21.5909	23.75	27.3485
4.00	4.6061	9.00	10.3636	14.00	16.1212	19.00	21.8788	24.00	27.6364
4.25	4.8939	9.25	10.6515	14.25	16.4091	19.25	22.1667	24.25	27.9242
4.50	5.1818	9.50	10.9394	14.50	16.6970	19.50	22.4545	24.50	28.2121
4.75	5.4697	9.75	11.2273	14.75	16.9848	19.75	22.7424	24.75	28.5000
5.00	5.7576	10.00	11.5152	15.00	17.2727	20.00	23.0303	25.00	28.7879
5.25	6.0455	10.25	11.8030	15.25	17.5606	20.25	23.3182	25.25	29.0758
5.50	6.3333	10.50	12.0909	15.50	17.8485	20.50	23.6061	25.50	29.3636
5.75	6.6212	10.75	12.3788	15.75	18.1364	20.75	23.8939	25.75	29.6515

Table Showing Knots Reduced to Miles.

A nautical mile or knot is 6,080.27 feet. For the benefit of those who are interested in the speed of sailing craft of all kinds, the Motor Boat has compiled a table of ready reference in which the various number of knots are reduced to land miles. The table will save a lot of figuring which would otherwise be necessary.

HOW TO CALCULATE SPEED.

To find the speed of a countershaft, if the revolutions of the main shaft and size pulleys are given: Multiply the revolutions of the main shaft by the diameter in inches of the pulley, and divide by the diameter in inches of the pulley on the countershaft; the quotient will be the number of revolutions, says the Practical Engineer.

Example:—What will be the speed of a countershaft with a 12-inch pulley, driven by a 30-inch pulley 180 revolutions per minute? $180 \times 30 \div 12 = 450$.

To find the size of a pulley required, if the number of revolutions and size of pulley on the main shaft are given: Multiply the diameter in inches of driving pulley by the revolutions of the main shaft, and divide by the speed required; the quotient will be the diameter in inches of the pulley.

Example.—What will be the diameter of a pulley to make a countershaft turn 450 revolutions per minute, driven by a 30-inch pulley 180 revolutions per minute? $180 \times 30 \div 450 = 12$-inch pulley.

To find the size of a pulley for a main shaft if the speed of shafts and diameter of the pulley on the countershafts are given: Multiply the diameter in inches of pulley by speed of the countershaft, and divide by the revolutions of the main shaft; the quotient will be the diameter of pulley.

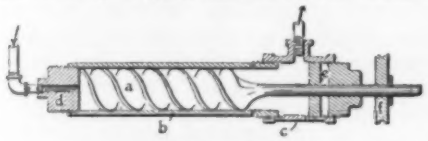
Example.—What will be the diameter of a pulley on a main shaft making 180 revolutions per minute to drive 12-inch pulley 450 revolutions per minute? $450 \times 12 \div 180 =$ 30-inch pulley.

A BLACK PAINT FOR IRON.

A good cheap black paint for iron work is prepared as follows: Solid wood tar, 10 pounds; lampblack or mineral black, 1¼ pounds; oil of turpentine, 5½ quarts. The tar is first heated in a large iron pot to boiling, or nearly so, and the heat is continued for about four hours, says Lead and Zinc News. The pot is then removed from fire out of doors, and while still warm, not hot, the turpentine mixed with the black is stirred in. If the varnish is too thick to dry quickly, add more turpentine. Benzine can be used instead of turpentine, but the results are not so good. Asphaltum is preferable to the cheap tar.

HOW TO MAKE A ROTARY OIL PUMP.

A rotary oil pump is simply and easily made. Place a ¾-inch auger bit (a), such as carpenters commonly use, inside a piece of ¾-inch brass pipe (b). Make connection at d by a plug turned down, threaded



A Rotary Pump.

and screwed into the threads cut into the end of the pipe and by the wall tee (c). Make a stuffing box (e) by sawing a plug in two parts and drilling a hole for the shank of the auger; f is the pulley belt. The pump should be driven at about 500 to 1,000 revolutions per minute, says Power.

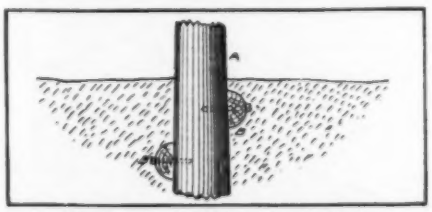
A GOOD RECIPE FOR HEAT-PROOF PAINT.

A good cylinder and exhaust pipe paint is made as follows:

Two pounds of black oxide of manganese, 3 pounds of graphite and 9 pounds of terra alba, thoroughly mixed. Add a compound of 10 parts of sodium silicate, 1 part of glucose and 4 parts of water, until the consistency is such that it can be applied with a brush.

UNDERGROUND BRACES FOR POLES.

In constructing telephone lines there are sometimes places where it is impossible to support a pole with guy wires. To meet this difficulty, says the American Telephone Jour-



Bracing Poles Without Guy Wires.

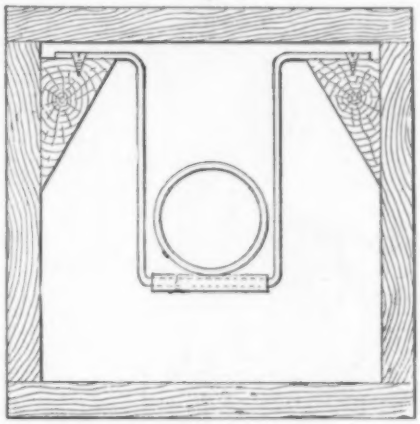
nal, underground pole braces are the proper support.

Two logs, B B, about five feet long, are shaped as illustrated and then bolted to the pole; the earth is then thoroughly tamped around them. A filling of stone will secure the logs much more firmly and in marshy ground this method of construction would be in a great degree successful.

When the logs are used in place of guy wires they should be placed as nearly at right angles to the direction of strain as possible, to secure the best results.

SUPPORTS FOR UNDERGROUND STEAM PIPE.

The following method of supporting underground steam pipe is highly recommended by a correspondent of Power: The pipe rests on a roller. A piece of iron rod of the proper length is selected and passed through a piece of iron pipe about the length of the diameter of the steam pipe; the iron rod is then bent and fastened as shown.



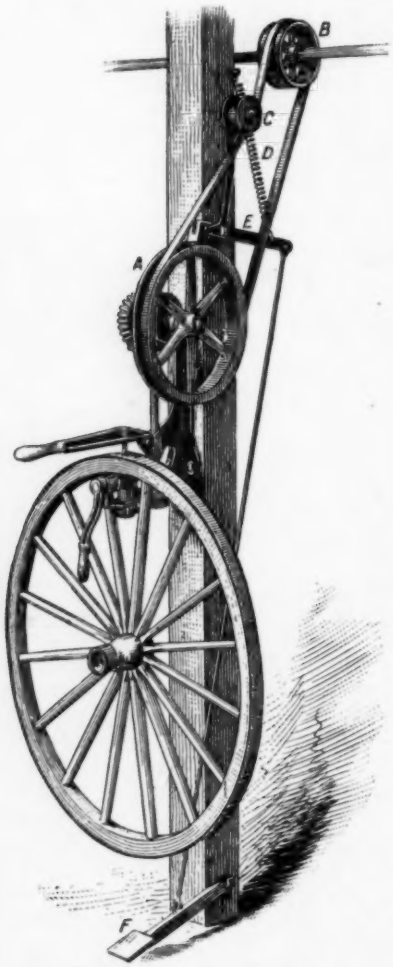
Laying Steam Pipe Underground.

Steam pipe for underground use should be carefully selected and the joints well made to prevent leakage; it is a good plan to use a mixture of graphite and cylinder oil in screwing up the connections. The best covering is made by laying cement mortar in the bottom of the trench and pressing into it a V-shaped wooden box, into which the pipe is laid. Over this place another wooden box and cover the whole with cement mortar, laying the bottom, top and sides of the cement all at the same time, so that one part will not set before another. The cement should set thoroughly before the steam is turned on. When there are bends in the pipe it should be provided with expansion joints and stop valves.

When cutting rubber sheets (sheet packing) dip the knife in water frequently and the work will be more easily done.

A HANDY TIRE BOLTER.

Twice the amount of work one can do by hand can be done by the use of the tire bolter here shown, says a correspondent of the Blacksmith and Wheelwright. The machine is run with a 1½-inch loose belt and a tightener and a 5-horsepower gasoline engine for power.



Attaching Power to a Tire Bolter.

Referring to the figure: A is a 16-inch pulley with a 3-inch face and two bands of 1x¼-inch iron shrunk around the edge of the wheel to keep the belt from slipping. B is an 8-inch drive pulley with a 4-inch face. C is the tightening pulley, three inches in diameter and having a 4-inch face with a flange on each edge. D is a spring that regulates the tightener and the brake. E is the brake that prevents the machine from turning when not at work. F is the treadle which is used to regulate the speed.

THE USE OF BAYBERRY WAX IN PATTERN MAKING.

The finishing of metal patterns is quite a question, especially in shops where a comparatively small number are made. Bronze patterns retain a very good surface without the use of any lacquer whatever, but in the case of iron patterns it is necessary to provide some coating for the surface of the pattern, says the Pattern Maker. If the iron is thoroughly cleaned and then coated with a solution made by dissolving bayberry wax in benzine or gasoline, it will be found that as the benzine or gasoline dries off it leaves a good firm coating of the wax, which gives a good surface and one that will wear well.

PAINT FOR WOOD OR STONE THAT RESISTS ALL MOISTURE.

The following recipe for a waterproof paint for wood or stone is given in the Architect and Builder:

Melt 12 ounces of resin; mix with it thoroughly 6 gallons of fish oil and 1 pound of melted sulphur; mix some ochre or any other coloring substance with a little linseed oil, enough to give it the right color and thickness; apply several coats of the hot composition with a brush. The first coat should be very thin.

HOW TO MEND RUBBER ARTICLES.

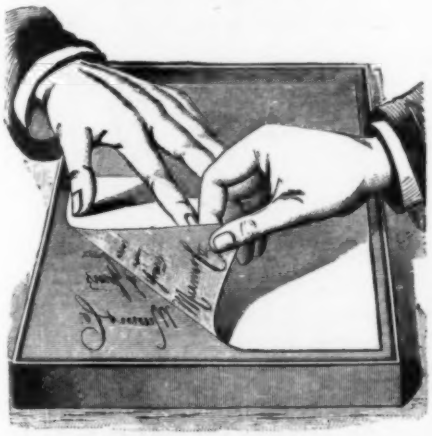
Clean off any particles that may adhere to the rubber and then dry the article or piece thoroughly. Emery paper or a file will remove varnish from rubber, and the part from which the varnish has been removed should then be rubbed over with benzine. Paint the edges of the hole with a solution of Para caoutchouc in benzine and lay over it a strip of natural rubber to fit. Then apply to the edges a solution of 400 parts of benzine, 300 parts of carbon disulphide, and 18 parts of sulphur chloride. Apply by means of some cotton wool tied to a wooden holder. The solution will vulcanize and increase the resistance of the rubber. Press the joined parts closely together.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A HECTOGRAPH.

A hectograph is very simply and easily made and by means of it many copies of writing can be obtained from a single original.

Make a tray of either tin or pasteboard, a little larger than the sheet of paper you ordinarily use and about ½-inch deep. Soak 1 ounce of gelatine in cold water over night and in the morning pour off the water. Heat 6½ ounces of glycerine to about 200 degrees F. (93 C.) on a water bath, and add the gelatine. This should give a clear glycerine solution of gelatine.



Using the Hectograph.

Place the tray so that it is perfectly level and pour in the gelatinous composition until it is nearly level with the edge of the tray. Cover it so the cover does not touch the surface of the composition and let it stand six hours, when it will be ready for use.

Make the copy to be reproduced on ordinary paper with aniline ink; using a steel pen, and making the lines rather heavy so they have a greenish color in the light. A good ink may be made of 1 ounce of aniline (2 R B or 3 B) dissolved in 7 fluid ounces of hot water. Cool and add 1 fluid ounce of glycerine, a few drops of ether and a drop of carbolic acid. Keep in a corked bottle.

When the original copy of the writing is ready moisten the surface of the hectograph slightly with a sponge, lay the copy face down upon it and smooth down, being careful to exclude all air bubbles and not shifting the paper. Leave it nearly a minute and raise one corner and strip it from the pad, where will remain a reversed copy of the inscription.

Immediately lay a piece of writing paper of the right size on the pad, smooth it down and then remove as before. It will bear a perfect copy of the original. Repeat the operation until the number of copies desired is obtained or until the ink on the pad is exhausted. Fifty or more copies can be obtained from a single original.

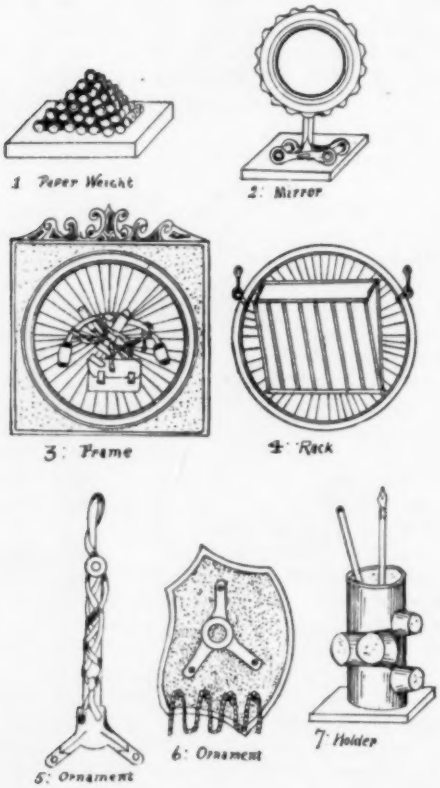
When through using the hectograph wash it off with a moist sponge, and it will be ready for future use. If the surface is impaired at any time it can be remelted in a water bath and poured into a tray as before, if it has not absorbed too much ink.

USEFUL ARTICLES AND ORNAMENTS MADE OF OLD BICYCLE PARTS.

A great deal of pleasure may be derived from turning parts of old bicycles into articles of use or ornamentation. Many original ideas can be used in this work and it is good practice for the boy of an inventive turn of mind. Sprocket gears, cone shafts, handle bars, wheel rims and other parts of old bicycles which were formerly disposed of as junk, are now carefully assorted, cleaned, polished or nickel plated, and used for wall and archway decorations. Plating outfits are expensive, but persons who possess them will do that part of the work for a small charge.

An idea of the character of the articles obtainable from cast-off bicycles is shown. Figure 1 is a collection of balls from several ball bearings, formed into a pyramid by means of cement, and nickle plated or gilded. The pyramid is then cemented to a wooden base and forms a useful desk paper weight. A table mirror (Fig. 2) is made by fastening a circular mirror to the center of a wheel sprocket gear; the stand is a pedal and pedal shaft. The pedal shaft is screwed tight to the pedal and consequently keeps the affair perpendicular. The sprocket, pedal and shaft are bronzed or plated and if desired, the sprocket may be wound with

fancy ribbon. Fig. 3 is an old wheel, the tire of which is filled with sawdust to keep it expanded, and in the center of which are several mementos of a by-gone cycle season, and all are hung to the wall. The tire of the wheel is artistically ornamented with oil or water colors or coated with silver bronze. The spokes are polished and the central articles are nickel plated, making an attractive showing. Another wall decoration of this order is shown at Fig. 4, in which the wheel tire is treated as before and prepared for a figure head or ordinary picture or wall mirror to be attached to the spokes. Fig. 5 is a pedal crank, plated and entwined with colored ribbons for hanging up. Memories of last season's wheeling are brought to mind by such designs as in Fig. 6. This is a spider, plated or gilded, and secured to a wooden base. There are pins beneath on which part of a chain is suspended. Perhaps this chain has a story



connected with it. It is finely polished or nickle plated and makes a memento of a bicycle which in its day had no equal in the estimation of its owner. The wooden base is either sanded or finished in natural state. Fig. 7 is a crank hanger separated from the tubes, japanned or bronzed, and used for a pencil and pen holder. Fig. 8 is a piece of hall furniture from which the hat

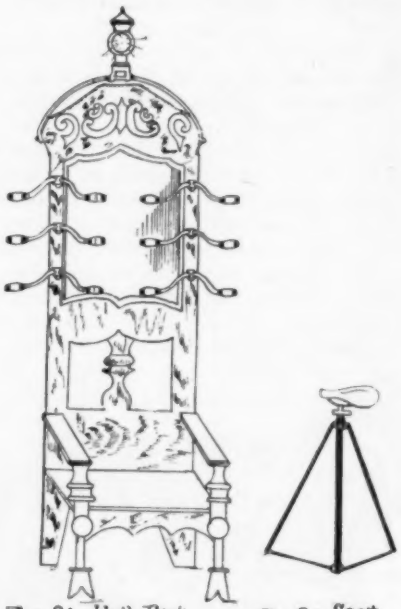


Fig 8: Hall Rack Fig 9: Seat

pins are removed and bicycle handle bars substituted. This is done by simply putting the bar posts through the original pin holes and securing the posts on the back by means of clamps. A cycle lantern is placed at the top, with fork and head piece, by expanding the fork and prongs to conform to the shape of the top. A set screw is put into the wood through the shaft holes in the forks and the whole affair is firmly held in place. The lantern can be kept in order and lighted. By cutting off the rear of the frame at the juncture of the seat pot lug and the crank hanger, a hall stool or seat can be made as in Fig. 9. The rear stays are spread out to form the necessary standing support for the affair. The tubing is re-enamelled or japanned and the bright work polished, while the saddle leather is treated to a surfacing of gold or silver composition, making an attractive and useful piece of hall furniture.

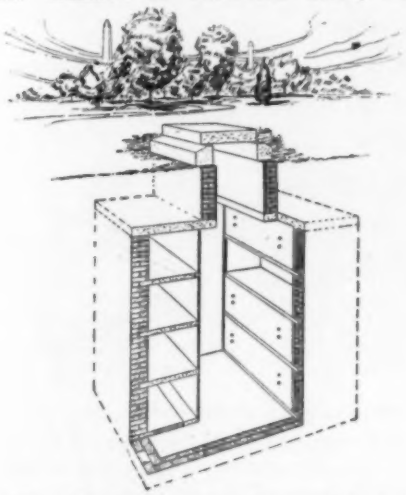
In 780 of the Southern Pacific Railway's 1,350 locomotives oil is used as fuel. In the shops at Sacramento, also, oil is used instead of coal.

Underground Vaults

New Method of Burial Recommended by Large Cemetery Companies

Brick graves, grave vaults and large underground vaults having a number of crypts are becoming common in many of the cemeteries of our large cities. In such places the mortality is always great and while the vault represents to bereaved persons means of ridding death of some of its horror, it finds favor with cemetery companies, because its use economizes space.

Many of these graves and vaults have been built in West Laurel Hill cemetery, Philadelphia. Single graves are built up of either common or enameled brick, have



Plan of Vault Having Eight Crypts and Shaft.

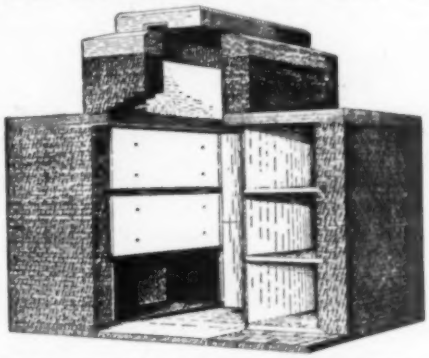
floors of brick or stone, and are covered with a slab or several slabs as wished; sometimes the grave is built up double with or without a partition between.

Lot vaults, however, are more common than the single brick graves, as they are suitable for any size lot. The walls are built up to provide for any number of crypts inside and provision is made for floor stones to separate the crypts. In some vaults there are as many as eight crypts. Above the vault proper is built the shaft, commonly of concrete reinforced by 1-inch round O bars of steel and expanded metal buried in the concrete. These walls may support a monument or may be covered below ground level by a stone and then covered with a depth of earth sufficient to support a lawn or any foliage and shrubbery desired.

One of the best features of this form of tomb is that the elements can in no way injure it. The plain heavy slabs especially adapted to it, are durable and in good taste, while they do not obstruct the landscape view.

Exterior View of Underground Tomb.

Entrance is secured through the top, which is often made of heavy glass. A portable stairway can be let down, and



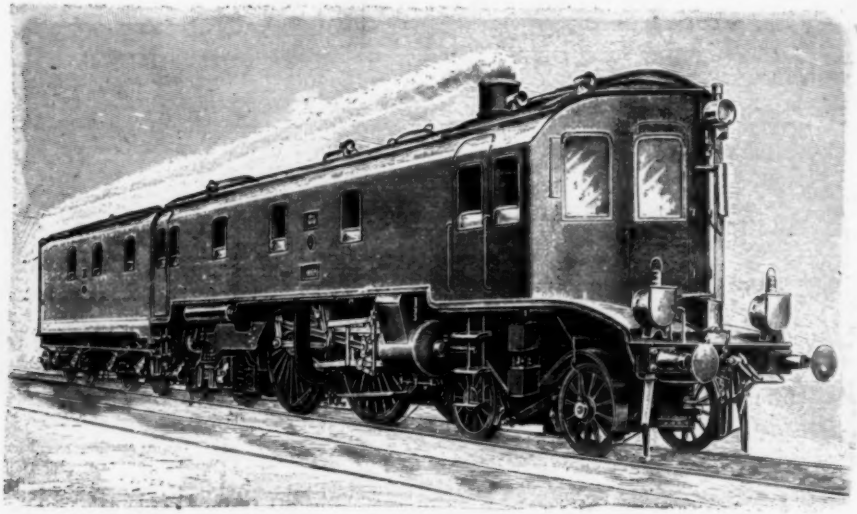
Underground Vault with Six Crypts and a Tomb.

taken out when the place is again closed.

It is impossible for any destructive agency to reach the interior of the strong vault, and those who mourn are haunted by no harrowing thoughts. So far as burial places are concerned the world is progressing backwards. The Egyptians knew more about the care of the body after death than do we with all our twentieth-century enlightenment and progress.

NEW GERMAN LOCOMOTIVE ATTAINS A HIGH SPEED.

A new type of locomotive for express purposes is being tested in Germany. The locomotive and tender are entirely cased in a metal sheathing which is keel-shaped in front to give the least air resistance possible, and in this one point it is expected that from 250 to 300 horsepower will be saved.



New Type of German Locomotive Has Engineer's Cab in Front—Attains High Speed.

The engine-driver's place is in a cab situated in the front of the pointed part of the engine. There is also in the cab a second or assistant driver, who also assists the stoker in his work. For running the engine backwards, which is found necessary in railway stations, the assistant-driver looks after the brake and whistle at the back of the tender. From here and also from the stoker's place, verbal messages can be sent to the driver's cab. In order to facilitate communications on the engines, there are passages on the right and left within the steel sheathing. At the back of the tender there is the usual passage to the train, so that it is possible to keep up communication throughout the whole length of the train, from the engine-driver in the front part to the guard at the end.

All the wheels of the tenders and locomotive are provided with air brakes, which exceed in power any other in use. The length of the locomotive alone is 38 feet. Its weight fully equipped is 94 tons, and the weight of the tender 64 tons. The tender carries 7 tons of coal. The locomotive is constructed for a speed of 80 miles an hour.

HOW TO TIGHTEN UP A SNARE DRUM.

The snare drum gets its name from the four or six small twisted rawhide cords stretched across the lower drum head. When the top head is struck these cords or snares snap sharply against the lower head and greatly increase the resonance of the drum.

It is interesting to watch a drummer tighten up the snare drum heads so as to produce an even tension of the parchments, says Railway and Locomotive Engineering. He first grasps the two press hoops with clamps united by steel rods with a small thumb nut on top of each. These clamps are placed at intervals all around the drum.

Let us suppose that a clock dial plate represents the drum head and the figures on the dial indicate the position of the clamps. The order of tightening the clamps would be much as follows: First the XII, IV and VIII, then X, II and VI and lastly XI, III and VII. Thus an even tension is obtained and the drum gives a sharper and better tone.

The great Simplon tunnel under the Alps and 12½ miles long is completed. It was begun in 1898.

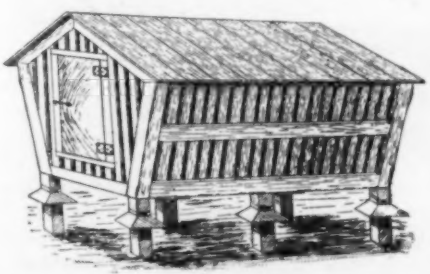
100,000 RUSSIAN SOLDIERS WILL WEAR BULLET-PROOF GARMENTS.

The Russian government has ordered from the company, established at Milan to manufacture the Bendetti cuirass, 100,000 of these breast-plates, which are destined for the armies in Manchuria. Last winter the inventor carried out some tests at St. Petersburg before the czar and high military officials, and it is claimed that the plate is proof against all small-arm projectiles. The cuirass to be supplied the Russian soldiers is flexible, weighs only 17 ounces, is less than half an inch in thickness, and entirely covers the chest and abdomen of the wearer. The United Service Gazette says: "The breast-plates were to be delivered at the Russian consulate at Milan on August 15, the sum to be paid for them being slightly in excess of half a million roubles. The factory in Milan employs 250 workmen, and the process is kept a profound secret."

HOW TO BUILD A RAT-PROOF CORN CRIB.

A corn crib which is cheaply and easily constructed is shown in the illustration herewith. The main feature of the crib is that it is rat-proof. It is constructed of inch lumber; open for air to reach the corn and with flaring sides for protection against rain.

The crib is set on either wooden posts or brick foundations, says the Indiana Farmer. The posts are set into the ground 15 inches and extend two feet above it, where the crib sills rest upon them. About 16 inches



Rats Cannot Climb These Posts.

above the ground are fastened galvanized iron hoods, projecting out and downward around the foundation posts 4 inches in width. Rats could not possibly climb past these. It is quite practicable to shape the hoods out of pieces of tin and nail them to the posts instead of buying the iron hoods.

LIVED IN THE WATER FIFTEEN DAYS.

A life suit in which the wearer can lie down or stand up with equal ease while in the water, is a valuable invention lately given to the world by M. Joseph Probst, a Swiss inventor at Geneva.

The suit is made of India rubber. It opens in the center and can be quickly and easily donned by the most excitable person.

M. Joseph Probst in His Wonderful Life Suit.

When attired in it the wearer is absolutely safe while in the water and it is possible for him to exist there several days. Air-tight compartments arranged on the outside, carry the necessary supplies for a prolonged stay in the water, and the apparatus includes an instrument for scaring away dangerous fish, says the American Inventor. Nearly one-half of the suit is above water at all times. As a test of his invention Mr. Probst remained in Lake Geneva 15 days and nights.

AUSTRALIANS PAY POSTAGE INTO SLOT MACHINES.

A new postal convenience is in use in Australia which would be highly appreciated in this country. It is a slot machine, in which, if no stamp can be procured, the letter and the penny postage are deposited, the words "one penny paid" being stamped on the envelope when the box is opened by the postoffice authorities.

LARGEST WIRELESS TELEGRAPHY STATION COMPLETED.

The largest wireless telegraphy station in the world was completed in September at Pisa, Italy. The buildings are entirely of stone. The machinery and apparatus are being placed as rapidly as possible and by the first of 1905 the station will be ready for receiving and transmitting messages. Wireless telegraphic communication will be established with England, Holland, the United States and Canada and with vessels in the Mediterranean, the Red sea, the Baltic sea and the Atlantic and Indian oceans. On the coast of Montenegro two Marconi stations are in complete working order and are used daily.

SOME PHOTOGRAPHIC CONTRASTS.

Never take a view with the sun directly behind you, says a correspondent of the Photographic News, and reference to Figs. 1 and 2 herewith given will show the worth

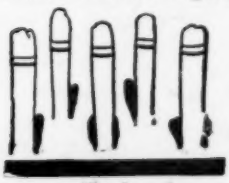


Fig. 1.

Fig. 2.

of the advice. Fig. 1 shows the result with the sun behind the photographer; the shape of the objects, shadows, and even perspective are lost. Fig. 2 shows the effect with the light coming from the side, and how great an improvement!

Another error to be guarded against is lack of foreground. Note the contrast between Fig. 3 and Fig. 4. In the former the object has been to get as much of the tree as possible, and consequently foreground has been sacrificed, and the tree looks as though it were anchored in the air, rather than firmly rooted in the earth. In Fig. 4 the top of the tree has been sacrificed to gain more foreground and the top-heavy and unsymmetrical effect thus eliminated.

Fig. 3.

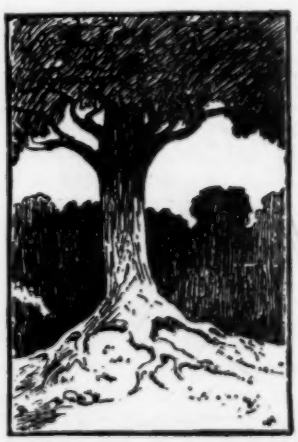


Fig. 4.

HOW TO MAKE REVERSED PRINTS DIRECT FROM THE NEGATIVE.

A straight print from a reversed negative may be made after the following method with as good results as if made in the regular way:

Fix an ordinary lens, the one used in making the negative will do, in the end of a packing box and lay the printing frame in the other end of the box with the glass side of the negative next to the paper inside that end. The lens end of the box should be turned to the sky or the light.

The rays of light must be so nearly parallel that they will print through the glass without perceptible blur, and the disc of light made by the lens should completely surround the frame.. The larger the disc the longer should be the exposure.

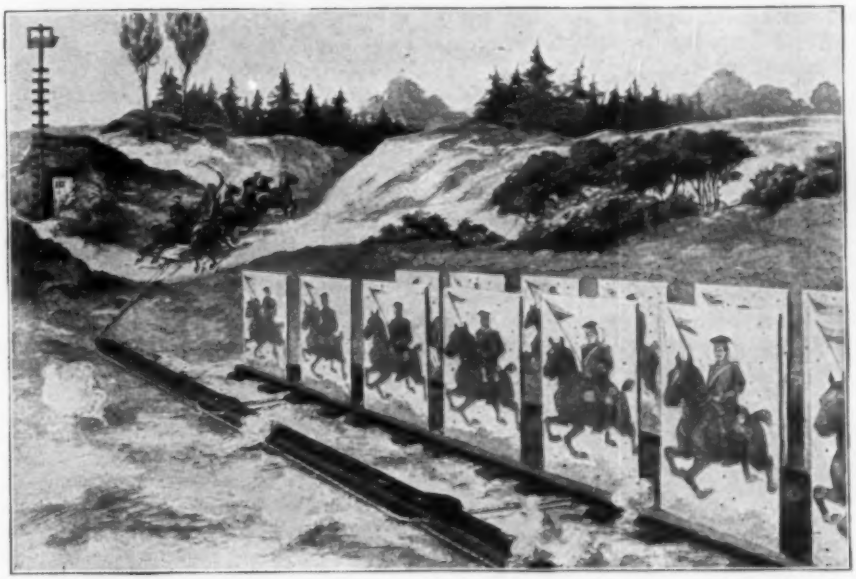
HOW TO MAKE HECTOGRAPH SHEETS.

Some people prefer hectograph sheets to the regular tablet, because the sheets are made on blotting paper and clean by standing, whereas the gelatinous tablet must be washed off when through using it or it will not make a clear print next time.

To make hectograph sheets soak 4 parts of glue in 5 parts of water and 3 parts of ammonia until it is soft. Heat it and add 3 parts of sugar and 8 parts of glycerine. Apply the mixture to blotting paper, saturating the paper and adding successive coats until one side has a smooth surface. Use the smooth side for reproducing the writing just as the tablet is used, excepting sponging them off.

Any number of these hectograph sheets may be made at a time and kept for future use.

Realistic Target Practice in the German Army



Life-Sized Pictorial Cavalry Used in Target Practice in the German Army

The German army has adopted a method of target practice in which a life-sized body of charging cavalry are fired upon by a force of riflemen, the cavalry advancing at full gallop, or the same rate as in an actual conflict. This novel target was adopted in order to test the number of telling shots made by the riflemen under those conditions.

The life-sized figures of the cavalry are painted upon a movable screen which is connected by strong ropes to an immense beam. These ropes pass over pulleys in the beam and thence along the beam, and to their ends is hitched a team of horses. These horses are set at full gallop and the pictorial cavalry charge toward the beam, while the infantry fire.

How to Pasteurize Milk

Milk can be successfully pasteurized in even a small way without the use of expensive machinery. Hoard's Dairyman gives the following directions:

Obtain a tank large enough to hold four or more deep setting pails about 8 inches in diameter and 20 inches deep. Have water and drainage pipes so arranged that the tank can be quickly filled and emptied. Fill the tank with sufficient hot water so that it will come above the milk in the cans. Set the cans of milk in the hot water and turn on enough steam from a small boiler to heat the water to about 160° F. Heat the milk in the cans with constant stirring, as rapidly as possible to 140° F. and hold at that point for 20 minutes.

Draw off the hot water and let a constant supply of cold water flow into the tank, stirring the milk in the meantime so that it may cool as rapidly as possible. It should be cooled to 50° F. or below. It will take some skill and experience to do the above successfully, as well as considerable work.

It should be understood that pasteurizing milk does not increase the purity, but only kills the bacteria that are present. If clean milk is desired, it must be obtained by methods of cleanliness in the stable.

LOCOMOTIVE HAULED ITSELF 300 MILES BY WATER.

Queerest Craft Ever Seen on the Ohio River Sailed From the Resolute Town of Pittsburg

"Always has been a lot of 'git-up-and-do' around about the town of Pittsburg," said an oldtimer who had divided his life serving on the Ohio river steamers and railroading. "It was about 35 years ago that this 'do-it-anyhow' disposition of Pittsburg added to the 'we-always-deliver-the-goods' fame of an early locomotive building firm, brought about the queerest looking craft that ever floated on the waters of the strenuous Ohio river. The firm was known as Smith & Porter. One J. Y. Smith was superintendent at that time. There was a railroad just 12 miles long running south out of Greenupsburg, Ky. This road had to have a locomotive built in quick time, and it contracted with Smith & Porter to build it. The locomotive had to be delivered by a certain day, or according to the agreement the contract was void. So the locomotive firm put extra men to work, and the locomotive was completed, tested and ready for shipment so as to reach its destination on the contracted date. But here's where the 'get-there-some-old-way' character of Pittsburg had to come in. It happened that the Ohio went down so rapidly at the time that on the day the locomotive was ready for shipment every towboat on the river was tied up, and not a craft of any kind was running. There were not any railroads running from Pittsburg to Greenupsburg, nor anywhere near there. No trains and no boats, with Greenupsburg 333 miles away, and the engine had to be delivered there in three days. What could be done?

"'Find a way or make it,' said that Superintendent Smith, when his foreman said there was no way of delivering the engine. Then what did that superintendent and foreman do? They simply went to work and built a 'locomotive-steamboat,' the queerest looking craft, as I said before, that the Ohio ever kept above water. The very locomotive that was to be delivered to the railroad was made to furnish the motive power for propelling the craft. The locomotive was made to haul itself to Greenupsburg by water.

"Smith and his assistants secured a flatboat. Engineer James M. Schooley helped him fix the locomotive in place. After the engine was properly lined up on the hull the side rods were disconnected and each coupled up to a temporary crankshaft placed across the boat, and each driving a paddle wheel.

"A supply of coal was placed on board, the engine fired up, and with the steam gauge indicating 120 pounds pressure Engineer Schooley opened the throttle.

"Steam rushed to the cylinders, the paddle-wheels began to revolve, and under the skillful guidance of the man at the wheel the locomotive headed for midstream. This is the only time on record that a locomotive navigated the Ohio river. The locomotive made the trip successfully and delivered itself to the railroad on contract time."

PURE AIR AND NO DRAFTS FOR STREET CARS.

A most effectual blow against pneumonia and the germ diseases has just been struck by the chief of the Brooklyn health department, and consists of a very simple method of ventilating street cars. In the deck-sash of the car he had two openings made about 10 inches apart and into these openings were fitted slats which deflect the intake of air to the roof of the car. From the side of the car between these openings was extended a shingle against which the wind strikes when the car is in motion. The whole scheme of ventilation then depends on the motion of the car at the average rate of 15 to 18 miles an hour. The air strikes the front of the shingle and is deflected into the car, while any dust or cinders it may carry fall from the shingle to the ground. At the same time the forward motion creates a vacuum in the rear which sucks out the impure air in the car through the rear slats. The cold pure air entering the car goes downward while the warmer impure air rises and passes out. In this manner 300 cubic feet of pure air enters the car at the front each minute and in the same length of time the same amount of impure air is exhausted from the rear.

In tests the atmosphere in a car was rendered unbearable and the car then set in motion and in two minutes and thirty seconds was absolutely pure, while a lighted taper did not show the motion of the air within the car. The street cars in our great cities, overcrowded and poorly ventilated, are the breeding places of disease.

Popular Mechanics five years only three dollars.

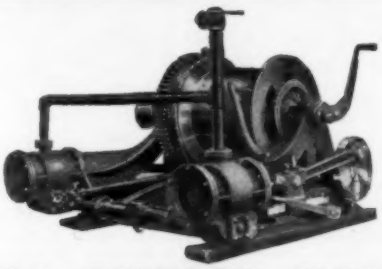
THE IDEAL SIGHT RESTORER

WE RESTORE SIGHT!

CLASSES RENDER DEFECTIVE VISION CHRONIC.

Write for our ILLUSTRATED TREATISE, Mailed Free.

THE IDEAL COMPANY,
239 BROADWAY,
NEW YORK.



THE QUINCY HOIST

8 x 10	Cylinders, Drum 14 x 20,	$496
8 x 10	Cylinders, Drum 24 x 24,	$505
8 x 10	Cylinders, Drum 30 x 30,	$525

YOUR CHOICE; FRICTION OR REVERSIBLE

Delivery f. o. b. Quincy, Ill., or Chicago

No discount from above prices.
Will ship subject to inspection and approval.
Modern, Quick, Strong, Efficient. Just the thing for pulling up cars or for small mines. Got 'em in stock. Order one.

WILLIS SHAW, - - Chicago
SOLE DISTRIBUTOR

SAVE MONEY! GET SECURITY! HOW?

By Installing A

Holtzer Watchman's Clock

Many a watchman has caught a blaze like this when on his rounds ringing in on a Holtzer Watchman's Clock.

It Reduces Your Insurance Rate | **It May Save Your Factory**

Do not wait until the fire catches you but write us to-day. Let us tell you all about it. **Ask for bulletin No. 1152.**

Holtzer-Cabot Electric Company
New York 398 Dearborn St., Chicago Brookline, Mass.

Pure Water

is a necessity; but, unfortunately, is scarce.

Why drink microbes in unpurified water? You need not--get a TEAKETTLE WATER STILL. Supplies water that's not only clear but absolutely sterile or free from dangerous germs. You don't have long to wait for it, either--gallon an hour--costs but little. Save your health. Send for Booklet.

Teakettle Water Still Co.,
117 W. Federal St., Youngstown, O.

Send three one-cent stamps for 5-color PICTURE OF LINCOLN PARK BRIDGE

W. L. STEBBINGS

Civil and Consulting Engineer
LICENSED ARCHITECT

Monadnock Block, - - - - - Chicago
Tel. Harrison 1104 Cable Address "Stebbings" Directory Code

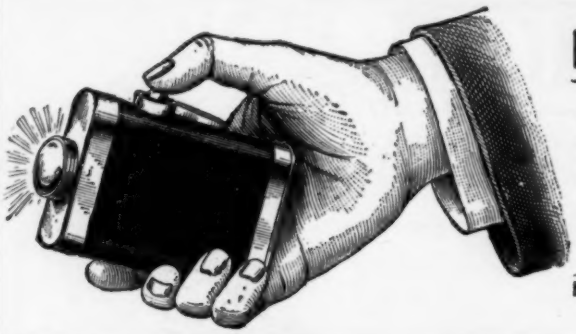
Columbia No. 1

A GOOD Drawing Table

CASH WITH ORDER. PRICE, **$5.00**

Adjustable to height and angle. Top of hard or soft wood 20 x 28 inches. Shipped in the knock-down by freight. Weight 50 lbs. Circulars free of full line of Tables.

The Hetterschied Mfg. Wks.
317 S. Division St.
GRAND RAPIDS, MICH.



THE RELIABLE

ELECTRIC VEST POCKET LIGHT

If you wish to find a house number at night; if you wish to find an article you have dropped; if you wish to avoid dangerous places in dark streets, just "press the button" and you have an instant, brilliant light. Will give eight thousand flashes, or burn three months with right usage. Inexpensive to buy and to operate!! Invaluable to physicians, or miners and gasfitters who go in dark places where any other form of light is dangerous. Batteries and bulbs easily detached and renewed when required.

$1.00—Complete—$1.00 Postage 10c extra. Extra batteries 30c. Extra bulbs 35c. Agents Wanted Write for prices in quantities and complete catalog.

HOWARD ELECTRICAL NOVELTY COMPANY
183 Lake Street, Chicago

"IF SLEEPING, WAKE,

If feasting, RISE before I turn away." It is the hour of FATE 'Tis

OPPORTUNITY

the ruler of human destinies, that speaks
Of many books there's ONE YOU NEED
'Tis unpretentious, and its name?

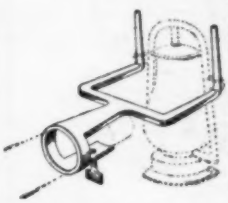
"A Guide to Full Pockets"

That's what most mortals need and if thy needs are common with the rest, **here** is the mystic key to **fortune, fame** and **joy.**
'Tis FREE, for fortune's smiles can ne'er be bought. Thousands have read and quickly grasped the offered boon. **'Tis now thy turn**—this call the **last to you.** If heeded not you'll seek in vain for that which will return no more. Send thou a postal card and we will tell thee all.

THE NUTRIOLA CO., 142 W. Madison St., Chicago, Ill.

UNIQUE LANTERN HOLDER.

A practical invention for holding a lantern is among the patents recently issued. The cut explains fully the method of using the holder which is placed on the end of the buggy shaft or wagon pole and fastened with a set screw. The lantern is thus held firmly in place and cannot swing and strike the horse's legs, while the lantern is placed where it will do the most good.



Send 50 cents for a copy of Shop Notes. Contains many practical and valuable hints for workmen of all crafts.

VALUABLE INFORMATION FOR
Expert and Amateur Machinists
Who Are Now Using Tools

You may have free our complete Catalogue of Fine Tools.

Fully illustrated, 176 pages. Gives useful information about all the new Mechanical Tools.

Every Tool we make is warranted accurate and satisfactory.

Ask for Catalogue No. 17 A. P. and send us your address.

THE L. S. STARRETT COMPANY,
ATHOL, - - - MASS.

Real Estate Mortgages at 6%

SAVINGS DEPOSITS AT 3%

GOVERNMENT BONDS AT 2%

ARE SAFE, BUT YOUR INCOME FROM THEM WILL NOT ADD MATERIALLY TO YOUR WEALTH

Your Investment

SHOULD BE PROFITABLE

A Mining Investment, if a successful one, yields larger Profits on the money invested than any other

THE Stock of **THE NORTH AMERICAN EXPLOITATION COMPANY** offers the opportunity for large profits that you are seeking. This Company's holdings are large and valuable. Its seven properties are developed and producing mines. Five are equipped with mills and reduction plants. Over $1,250,000 was originally paid for the properties and over $700,000 has been expended in their development and equipment. There are over 75,000 tons of ore now in sight worth over $1,500,000. Its combined earning capacity permits of large and continuous dividends. Its "Eggs are not in a single basket." It is not a question of "Will it pay?" but, "How much?"

IT SHOULD ALSO BE SAFE

Every purchaser of the Treasury Stock of the Company, receives, to the extent of his investment, a **FIRST LIEN GOLD BOND**, bearing 6 per cent guaranteed interest, payable on or before 5 years, secured by the entire assets of the Company—this makes your investment safe, besides effecting the return of your money within a brief period, and leaving the stock you hold, as a bonus.

The first allotment of Treasury Stock is now offered for subscription at a special "organization" price. For Prospectus, Copy of Bond and full particulars, address,

THE WESTERN TRUST & GUARANTEE CO.

FISCAL AGENTS

New York Life Bldg. **CHICAGO, ILL.**

RHEUMATISM

Cured by Absorption

Magic Foot Drafts Draw Impurities From the Blood Through the Foot Pores, Removing Cause of Pain

A DOLLAR PAIR FREE

On Approval if You Write at Once.

Don't suffer needlessly. Magic Foot Drafts cure such a large percentage of cases that the makers have decided to send them **FREE ON APPROVAL** to every sufferer they can hear of. Send us your name to-day. Return mail will bring you a pair of the celebrated Drafts (the genuine), which have already cured so many cases considered incurable. If you are satisfied with the benefit received, send us one dollar. If not, send nothing. **YOU DECIDE.**

Magic Foot Drafts are worn on the soles of the feet because both the circulatory and the nervous systems are most easily reached there, but they cure Rheumatism to stay cured in every part of the body by removing the cause from the system. Our new illustrated book on rheumatism is sent free with the Drafts. **MAGIC FOOT DRAFT CO.,** 1051 Oliver Building, Jackson, Mich. Write today.

ECZEMA

sufferers, read what

Hydrozone

and **GLYCOZONE** have done for a celebrated journalist in **one week.**

Prof. Charles Marchand.

Dear Sir: One week's treatment with your Hydrozone and Glycozone not only relieved but absolutely rooted out a condition of eczema that has worried and perplexed me for the past ten years. Yours very truly,
Joseph Howard, Jr., 150 Nassau St., N. Y.

Free trial bottles of **Hydrozone** and **Glycozone** sent on receipt of 35c. to pay express charges. These preparations are harmless, yet powerful germicides, used by leading physicians. *Sold by best druggists.*

Prof. Charles Marchand

L-63 Prince Street, New York.

Send for booklet how to prevent and cure disease.

American

AIR RADIATOR

Gives 3 times the heat with ⅓ the fuel. Attached to any heater or cook stove.

J. W. BROWN & CO.
99 Dearborn St., Chicago

Responsible Agents Wanted. Exclusive territory. Sells at sight.

50 Per Cent Off
Our Catalogue Prices

Hereafter we will give to the public direct in full all teacher's and dealer's discounts on

VIOLINS, GUITARS, MANDOLINS and other stringed instruments. Our standard **Lewis Orchestra No. 1. Violin** (worth easily $25 to $30 among dealers; listed in our catalogue for years at $21; now **$10.50 net** direct to you). The famous Lewis Durer $65 violins for $32.50. Other values from $3.50 to $125.00 and upward. We are the largest and oldest exclusive stringed instrument house in the U. S. and import direct from our own workshop in Eisleben, Germany, and Padua, Italy.

TEN DAYS FREE TRIAL of any instrument. Write for Catalogue.

WM. LEWIS & SON, 211 B Wabash Avenue, CHICAGO

☞ Specialty in strings for professional trade.

THERMO-PILES

1½ Volts **1½ Amperes**

For Electrolytic Analysis, Charging Storage Batteries, Driving Small Motors, Etc. No chemicals, no smell. **$3.00 EACH.**

WALSH'S SONS & CO., 261 Washington St., Newark, N.J.

ROYALTY PAID and Musical Compositions. We arrange and popularize.

—ON—

SONG-POEMS PIONEER PUB. CO., 627 BALTIMORE BLDG., Chicago, Ill.

WANTED

10 men in each state to travel, tack signs and distribute samples and circulars of our goods. Salary $60.00 per month, $3.00 per day for expenses.

KUHLMAN CO., Dept. B, Atlas Block, CHICAGO

TALKS WITH INVENTORS.

A recent decision of the Commissioner of Patents emphasizes the importance in an inventor filing his application for patent. The case decided was between two parties, each of whom claimed to have invented the same machine for making pool balls. One of the parties, Matthes by name, proved that he invented the machine in June, 1898, and that he made a few pool balls on said machine at that time. The other party, Burt, proved that he invented the machine in December, 1899. Burt applied for a patent in April, 1901, and at once began the manufacture of pool balls on his machine. Matthes learned in December, 1901, that Burt was making pool balls on a machine exactly like the one that he, Matthes, invented in June, 1899, and he at once, or in February, 1902, applied for a patent before a patent had been granted to Burt.

The Commissioner decided that notwithstanding Matthes was the first inventor, that he did nothing until he learned that Burt, his competitor, was using the invention, and that by his silence and failure to apply for a patent he is presumed to have abandoned the invention, and that Burt, who was a bona fide independent inventor, even though he came after Matthes, was diligent and had done all that the law expected of him, and therefore should receive the patent. The Commissioner, after quoting several decisions of the United States Court of Appeals on cases where similar conditions prevail, says: "From the aforegoing cases we may extract the principle that an inventor who has completed the inventive act by the reduction of his invention to practice may lose his right to obtain a patent, in favor of a subsequent inventor, by concealment and delay in applying for a patent." The term "reduction in practice" means either the making and placing on the market of the invention, or the public use of it, or the filing of an application for a patent.

Many inventors lose their inventions by procrastination in applying for a patent or in placing the invention before the public. They wait until others have gone ahead and done these things and then try to come in at the eleventh hour and prove that the invention is theirs. As seen from the above decision, the inventor who does this runs the risk of losing everything.

STILL, HE TIPPLES A LITTLE.

Give John Bull a chance. He is not perhaps the abstemious man he might be, but he certainly is not, as you say, the "champion guzzler" of the world. He is not even in the running for the title, as the following figures prove: Where the average Belgian drinks 710 glasses of beer in a year, the Briton is content with a shade over 500; for every glass of wine drunk in the United Kingdom, France drinks 56, and the Dane drinks seven glasses of spirits for every one the average son of John Bull consumes. Among all the nations of Europe John takes second place as a beer-drinker, eighth as a consumer of wine, and tenth as a lover of spirits.—London Tit-Bits.

REPLACED A SCALP.

A few weeks ago a girl in New York had her scalp torn from her head in an automobile accident. After the girl had been taken to the hospital the scalp was picked up in the road by a policeman and sent to the hospital where it was replaced on the young lady's head. Strange to relate, the remarkable operation is proving wholly successful. The cuticle has begun to unite and the hair shows signs of vitality and attending physicians have announced that a healthy glow is now apparent in the scalp.

DO YOU WANT TO DRESS STYLISHLY

Do you want an **all-wool** suit or overcoat **made for you,** and **to fit you,** from the newest fashionable fabrics? Do you want to be **absolutely satisfied** before you pay for the garments? Do you want a pair of **all-wool,** stylishly made

$5 TROUSERS FREE

of cost to you for doing us a favor? Then **read carefully** and **act promptly** on this

Special Offer:

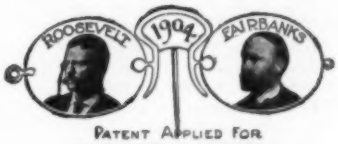
We will send you samples of all-wool Clay Worsteds, Thibets, Serges and Cassimeres, in black, blue, brown and fancy mixtures, from which we will make you a suit or overcoat for $10.00, **the equal of which you cannot buy for $15 anywhere else,** and give you an extra pair of $5.00 All-Wool Trousers **without charge,** providing you will hand ten sets of samples (which we furnish you free), to ten men who will be likely to buy suits on our **exceedingly liberal terms.**

Don't take our word for it. Just give us the opportunity to **prove** that we can and will **save you money** and **give you absolute satisfaction.** You take no risk. We make your suit, send it to you and give you ten days time to **actually wear the garments** to prove their positive worth. That's fair, isn't it? Write to-day for our New All-Wool $10 Suit Samples—also ask for our Superb special prices—our New Imported All-Wool Fall Fabrics at $12.50, $15.00 and $18.00 Fall Style Book and Complete Instructions for taking measures, **all sent free,** together with our Presidential Proposition, that **pays you $2.50 in cash before you get your suit.**

OWEN T. MOSES & CO., 212 MOSES BLDG., CHICAGO

References: Your friends, or Milwaukee Ave. State Bank, Chicago. Capital $250,000.

Show Your Colors



PATENT APPLIED FOR

BOY OR MAN

Encourage your party by showing which "side of the fence" you are on.

Our Campaign Novelties

are unique, attractive and artistic. **Roosevelt and Fairbanks Eyeglass Pins** [see cut above] gold plated. **Sample Price 25c.,** postpaid. Same for **Parker and Davis.**

Campaign Fob. Handsomely nickeled — lettering enameled in three colors, russet leather strap and nickeled buckle; for both candidates. Sample price 25c., postpaid. Special quantity prices to agents.

Both These Are Great Sellers.

Write for samples today.

Cash Must Accompany Order.

CHICAGO COMMERCIAL AND SPECIALTY CO.,

528 W. 63rd ST., DEPT. A., CHICAGO, ILLINOIS

YOU CANNOT "MAKE BRICKS WITHOUT STRAW" BUT YOU CAN SECURE ANY OF THESE

High Grade Tools Without Money

The following carefully selected list of tools includes those which every mechanic needs, and which everyone who engages in mechanical work as a recreation will greatly desire to possess. We have selected a well-known brand, the excellence of which for quality and accuracy is beyond criticism. They are all from the celebrated works of the L. S. Starrett Company, manufacturers of fine mechanical tools. Every tool in these lists can be easily earned by securing a small club of new yearly subscribers to Popular Mechanics;

ANY TOOL IN THIS LIST FOR ONE NEW SUBSCRIBER

		Retail Price.
No. 303	4-in. Spring Tempered Rule	$ .45
No. 403	4-in. Beveled Edge Rule	.45
No. 330	4-in. Narrow Hook Rule	.45
No. 391	Spring Tempered Center Gage	.45
No. 450	Folding Pocket Rule in case	.50
No. 135	Nickel Plated Pocket Level	.50

ANY TOOL IN THIS LIST FOR TWO NEW SUBSCRIBERS

No. 303	Spring Tempered Rule, 9-in	1.00
No. 403	Beveled Edge Rule, 9 in	1.00
No. 420	Hook Rule, 6 in	1.00
No. 21	Thin Straight Try Square, 2 in.	1.00
No. 125	Adjustable Caliper Gage, 2½-in	1.00
No. 193	Protractor	1.00
No. 40	Screw Pitch Gage	1.00
No. 172	Thickness Gage	1.00
No. 87	Mercury Plumb Bob	1.00
No. 146	Adjustable Hack Saw Frame and Blade	1.00
No. 104	Speed Indicator	1.00
One Dozen No. 116 Asst. Nail Sets, in case		1.15

ANY TOOL IN THIS LIST FOR THREE NAMES EACH

ANY TOOL IN LIST 1 AND LIST 2, OR,

No. 405	Patent Draftsman's Scale, 12 in	$1.50
No. 380	Steel Straight Edge, 18 in	1.80
No. 11	12-in. Combination Square	2.00
No. 60	6-in. Reliable Try Square	1.25
No. 425	Slide Caliper Rule, 3 in	2.00
No. 15	3-in. Universal Bevel	1.50
No. 6	Screw Pitch Gage	1.50
No. 36 or 37	6-in. Lock Joint Transfer Calipers	1.50
No. 186	Drill and Steel Wire Gage	1.50
No. 132	6-in. Level	1.50

TOOLS IN THIS LIST FOR FIVE NAMES EACH

ANY TOOL IN LIST 2 AND LIST 3, OR

No. 380	24-in. Straight Edge	$2.40
No. 510	Steel Tape in Leather Case, 50 in	4.00
No. 9	12-in. Combination Square Set	4.00
No. 33	Hardened Steel Combination Squares, Drop Forged	3.00
No. 20	4½-in. Hardened Edge Solid Steel Square	3.50
No. 25	4-in. Caliper Square with Adjustable Screw	4.00
No. 66	Locomotive Guide Liner	3.00
No. 57	New Universal Surface Gage, 12 in	3.00
No. 97	12-in. Improved Level for Testing Shafting	2.50
No. 197	12-in. Electrician's Level Non-Magnetic	3.50
No. 163	24-in. Draughtsmen's T. Square	3.50

TOOLS IN THIS LIST FOR TEN NAMES EACH

ANY TOOL IN LIST 1 AND LIST 5, OR,

No. 3	1-in. Micrometer in Case	$6.50
No. 113	1-in. Micrometer in Case	7.50
No. 2	2-in. Micrometer in Case	7.25
No. 124	B. Inside Micrometer	6.25
No. 360	Universal Bevel Protractor	5.75
No. 196	Universal Dial Test Indicator with Tool Post	7.50

Any tool in the Starrett Catalog desired, and not given above, will be given as a premium for a club. ∴ ∴ For particulars address

POPULAR MECHANICS : : Journal Building : : CHICAGO

CO-OPERATION

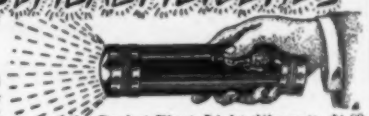
is the mystic key to fortune, fame and happiness. We hold the **key**, but cannot turn it alone. We will share with **you** in the greatest **money-making** co-operative business on earth. We are **giving away 250,000 shares** of Treasury stock. Par value $1.00 per share. Not a share can be bought for cash.

There's 20 Shares for You

No more for anyone. **We don't want your money**, don't send us a cent, just a postal card. Our plan is **unlike** that of the trusts who give millions of shares to drones, called "promoters." We **are giving ours to partners**—energetic men and women. This stock will pay large dividends and costs you—just a **little effort—that is all**—fortune's knock is at your door, believe it or not, as you please.

THE PEOPLE'S COMPANY
144 West Madison Street, Chicago

Electrical Novelties



Our Free Catalogue describes many other electrical novelties. We promptly refund money if dissatisfied.

Agents Wanted These novelties sell on sight and are easily shown. Everybody is interested. We want good, live agents in every place, big or small. All particulars for a postal. Write today.

Pocket Elect. Light (like cut)	$1.00
Telephones, complete	$2.50 to $5.95
Door-Bell Outfit, complete	1.00
Telegraph Outfits	2.00
Home Medical Batteries	1.00 to 6.50
Battery Motors	75c. to 12.00
Bicycle Electric Lamps	3.50
Electric Hall and Porch Lamps	3.00
Electrical Carriage Lamps	5.00
Water Motor and Dynamo	10.00
1-2 h. p. direct current motor	20.00
Miniature Electric Railways	3.25
Electric Scarf Pin	1.00

J. W. SCRIBNER & CO., 197 Niagara St., Tonawanda, N. Y.

THE OLD FASHIONED WASHBOARD

By John J. Hurley.

How dear to my heart is the old-fashioned washboard
That mother used washing when I was a boy,
With its zinc-covered ridges the suds used to play in,
And soap bubbles gamboled to my childish joy.
Ofttimes have I watched her when wearing her knuckles,
As over the ridges our duds she would rub,
I ne'er will forget how she splashed and she slathered
The old-fashioned washboard that stood in the tub.

(Chorus)

The old-fashioned washboard;
The zinc-covered washboard;
The back-breaking washboard that stood in the tub.

I'll always remember when school it was over,
And home I returned I never could pass
Unless I jumped over the white sheets and napkins
That mother had spread out to bleach on the grass.
And poor mother lay on the old-fashioned sofa,
All played out, and I'd have to eat just cold grub,
She never had hot lunch for me when she tackled
The old-fashioned washboard that stood in the tub.

(Chorus)

Some folks always kick about up-to-date laundries,
And say that they wear out their clothes every day;
But give them to me, so I'll have a hot dinner
At home, and the smell of the soap-suds away.
I know that the washing machine is much easier
On all of our clothes than to take them and rub
Till the buttons and bosoms are lost and worn out
By the old-fashioned washboard that stood in the tub.

WILL GIVE FARMS TO EMPLOYES.

The Pennsylvania Railroad contemplates parceling out to its employes hundreds of acres of its desirable lands along railway routes, each of the employes thereby becoming proprietor of a small farm. In France 15,000 railway employes have free use of such farms and the plan is considered a great success.

HOW CONGRESSMEN TOIL.

If comfort and convenience are highly conducive to the production of good laws and to able management of the ship of state, it seems that legislators in the United States Capitol should lead the world in the latter particulars.

But the congressman, so well fixed, is not satisfied—he desires more room. So a large amount of money will be spent for a congressional office building, where his clerk can attend to correspondence, ship seed, literature, etc., and where constituents and others can be seen. The new building, to be begun this summer, will be a handsome stone structure, containing several hundred rooms, located near the southeastern corner of the Capitol grounds, fronting on New Jersey avenue and B street.

When the lawmaker takes his seat at his handsome desk ready for the business of the session, if he so chooses he can sit there all day without saying a word (though silence is not considered "golden" in the House), except when voting. If the M. C. desires anything while in his seat he does not, as was once the custom, clap his hands for a House page; it is only necessary to touch a button. An independent call apparatus is located in each corner of the Hall. The device is placed on a small table and consists of an exposed series of numbered platinum disks. Each device takes care of 200 desks. The desks on the Democratic side of the House range in numbers from 1 to 200; those on the Republican side from 201 to 400. At the right-hand side of each desk and attached to the bottom is an electric push button. Pressing this the circuit is closed and a current flows to the registering device corresponding to the number of the desk button. The disk appears red-brown, and after about 30 seconds resumes its normal color. The operation is entirely without noise, and the person in charge of a call station sends a page to the number registered.

A $200,000 tomb awaits a man living at Riverdale-on-Hudson in a barn on an estate he once owned. It, of course, makes little difference how he must live now, he is sure to have a decent burial. However, it may be some one's opportunity to get a magnificent tomb at something less than cost.

Jacobs (the swell): "Goot morning, Isaac. Vill you have a cigar?"

Isaac (astonished): "Vhy, Jacobs, vat is the matter vid it?"

SAVE MONEY BY MAKING YOUR OWN BOILER COMPOUND. We furnish formulae for effective and economical **Boiler Compounds** based on an Analysis of your feed water.

THE ELLSWORTH LABORATORIES

SLIMMER & STILWELL, Ana'ytical Chemists 357 DEARBORN ST., CHICAGO

CARBURETTOR TROUBLES CURED

The Landgraf Carburettor will make your engine go if there is any go in it. We guarantee it.

FURNISHED FOR MOTOR CYCLES, AUTOMOBILES, STATIONARY ENGINES and LAUNCHES

Crank Hangers for motorcycle builders; special, wide bracket with lugs for drop frame to take large motor. Crank hangers to fit any make and style of bicycle. SPROCKET MILLING AND MACHINE WORK.

Every motorcycle builder should get our circulars on carburettors and motorcycle hangers, and every bicycle shop should use our repair hanger. Write us for prices and trade discounts.

THE A. & J. MANUFACTURING CO., • 17 South Canal St., Chicago

The American Well Wks.

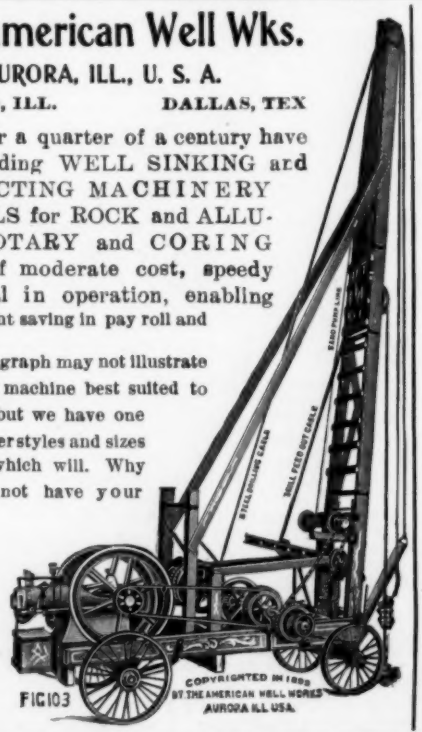
AURORA, ILL., U. S. A.

CHICAGO, ILL. DALLAS, TEX

For over a quarter of a century have been building WELL SINKING and PROSPECTING MACHINERY and TOOLS for ROCK and ALLUVIAL, ROTARY and CORING WORK of moderate cost, speedy economical in operation, enabling large per cent saving in pay roll and pipe bills.

This photograph may not illustrate the style of machine best suited to your work, but we have one hundred other styles and sizes some of which will. Why should we not have your orders?

We have pleased old customers, can please new ones.



WHERE HAY FIELD BEATS GOLD MINE.

Hay clears a profit of 100 per cent in the Yukon valley, while gold—well, gold is all right if one is fortunate enough to get hold of it, but the chances are a good hay crop will pan out better than gold prospects.

A Dawson freighter at Gravel Lake, on the trail between Dawson and the Duncan district, Stewart river, put in an immense quantity of fine hay last fall. Last winter he baled 600 tons of hay for which he received $140 per ton, or $84,000 for the entire crop. The entire crop was cut by scythes and handled in the old-fashioned way. A crew of ten men and two 6-mule teams collected the bales and carried them to market. Next year the Alaskan farmer proposes to use the most modern of farm implements.

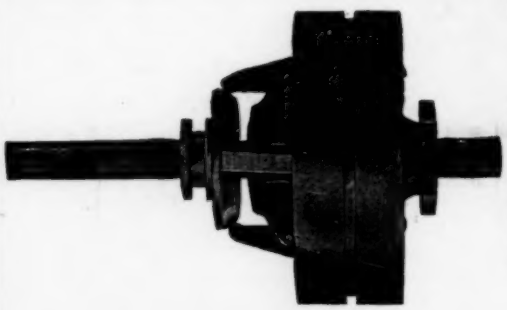
BLACK PAPER RESTS THE EYES.

Will the time come when all our books, magazines, newspapers and current literature of any kind will be printed in white letters on black paper?

Prominent medical authorities have discussed the point several times, claiming that the black paper rests the eyes, where the glare of the white paper tires and even injures them.

Recently the subject has again been brought to notice by Dr. Arthur Fisher, of Montreal, before the Hahnemann Society, and was favorably commented on.

Technical difficulties have prevented even a fair trial of the remedy for weak eyes hitherto, and there are other objections and weak points, but should the change ever take place it will be revolutionary in its effects.



Transmissions

The "Standard" 8 and 20 H. P. MADE FOR USE. Best of WORKMANSHIP and MATERIAL. Write for our descriptive matter, and prices. Send 5c postage for 90 page catalogue of all supplies.

The Automobile Supply Co.

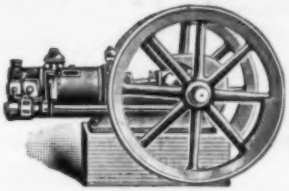
Successors to THE P. J. DASEY CO.

339 Michigan Blvd. Chicago, Ill., U. S. A.

The Marked Superiority of the

"OTTO" GAS AND GASOLINE ENGINES

In ease of starting and smoothness of running is readily apparent when compared, side by side with the cheaper kind.



While "comparisons are odious," they are sometimes helpful in arriving at the truth. See our exhibit at the World's Fair, Block No. 41, Machinery Hall, and draw your own conclusions.

***The* OTTO GAS ENGINE WORKS, Philadelphia, Pa.**

CHICAGO: 360 Dearborn St. MINNEAPOLIS: 318 3d St. OMAHA: 1108 Farnam St.

ASK FOR CATALOG F.

THE "GUS" GAS AND GASOLINE ENGINES

NONE BETTER MADE

CATALOG UPON REQUEST

THE CARL ANDERSON CO.

23-27 N. CLINTON ST. CHICAGO

Fire It Right Back

AT OUR EXPENSE

That's what you want to do if you can find any fault with our new Dust Proof 2¼ H. P. Engine. We are making a Specialty of this one size Gasoline Engine and build nothing else.

They are designed right to start with, and then built so they will last even under severe service. Our price is $138.00, complete and ready to run when delivered.

Get Our "Money Back" Offer

McNAUGHTON-BASSETT CO. Charlotte, Mich.

Dynamo and Motor Bargains

We carry in stock over 600 machines in all sizes from ⅛ to 100 horse power, both new and second hand, *all guaranteed*. Small factory equipments our specialty.

NO ONE

Can sell you a first-class machine for less money. We repair all makes. Send us your inquiries.

Guarantee Electric Co.

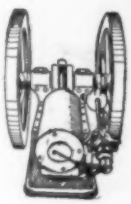
CHAS. E. GREGORY, Pres.

153 to 159 S. Clinton St.,

CHICAGO

CRANE FITTINGS

ESTABLISHED 1855



Gasoline Engines

"HONESTY IS THE BEST POLICY"

THIS IS OUR POLICY

LET US PROVE IT TO YOU

Send for Catalogue. Engines 1 to 500 H. P.

CAVANAUGH & DARLEY

25 West Randolph Street, Chicago

NEW AND SECOND-HAND ELECTRICAL **MACHINERY**

COMPLETE PLANTS INSTALLED.

Expert Electrical Repairers of Armatures, Fields and Commutators.

ILLINOIS ELECTRICAL MFG. CO.

1222 S. Adams St. Peoria, Illinois

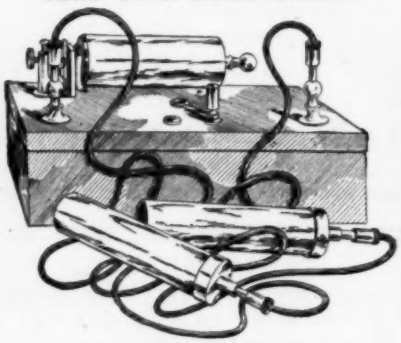
ELECTRICITY

BOOK FREE

Profusely Illustrated From Life, Shows How and Why Electricity Cures and Prevents Sickness.

SEND YOUR NAME TODAY.

Our No. 4, Only $1.95



Express Prepaid

Why not find out what electricity will do for you? Write today for our new Free Book—**"Cure Yourself By Electricity"**—illustrated with photos from life. Shows how the New Home Batteries cure **Rheumatism, Neuralgia, Lumbago, Headache, Insomnia. Constipation** and all **nerve** affections and diseases arising from **sluggish circulation**; also how they afford **electric baths** and **beauty massage** without cost at home. We send our batteries **Prepaid on Approval** without a cent in advance (prices $1.95 and up) and allow **10 Days Free Trial.**

Write For Our Book.

Detroit Medical Battery Co.,
1039 Walker Block, Detroit, Mich.

STEVENS

A Day in the Woods

with a trusty **FIREARM** as a companion is both enjoyable and beneficial to the health. **NOW** is the time to feel the thrill of the great "out-of-doors." Your happiness will be complete if equipped with a "STEVENS."

We manufacture an extensive and varied line of

RIFLES, PISTOLS, SHOTGUNS

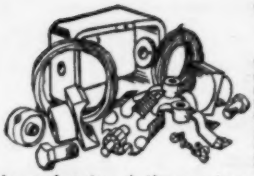
suitable for young and old of either sex

Your dealer handles STEVENS ARMS. Where not sold by Retailers we ship direct, EXPRESS PREPAID, upon receipt of catalog price.

Send 4c. in stamps to cover postage on 136-page illustrated STEVENS book, with cover design by A. B. Frost. A manual of ready reference indispensable to all who shoot or are going to

HIT THE MARK with our RIFLE PUZZLE! This clever novelty will be mailed FREE anywhere upon request.

J. STEVENS ARMS & TOOL CO.
40 Main St.,
Chicopee Falls, Mass., U. S. A.



YOUNG MEN why don't you build your dynamo motor or water power plant? Our finished parts are modern, up-to-date and complete. No tools or machine shop needed to make a successful machine. They furnish an opportunity to wind a dynamo and try your own work at a less expense than any other known method. Indorsed by all electrical students. Sizes 25-50-75 watt 1-4 and 1-2 h. p. Catalogue, 4 cents. Active agents wanted.

C. S. Piper & Co., 4352 Cottage Grove Ave., Chicago.

IMPORTED IMITATION

DEDION SPARK PLUGS JUST NOW - - - 40 cent each

THE MOTOR CAR SUPPLY CO.
1427 Michigan Ave., Chicago, Ill.

STRANGE TREES OF STRANGE CLIMES.

On the Canary islands grows a fountain tree, a tree most needed in some parts of the island. It is said that the leaves constantly distill a quantity of water that is sufficient to furnish drink to every living creature in Hiero, nature having provided this remedy for the drouth of the island. Every morning near this part of the island a cloud of mist arises from the sea, which the winds force against the steep cliff on which this tree grows, and it is from the mist that the tree distills the water.

China, too, claims her remarkable tree. This is known as the tallow tree, so called from the fact of it producing a substance like tallow, and which serves the same purpose, is of the same consistency, color and smell. On the island of Lewchew grows a tree about the size of a common cherry tree, which possesses the peculiarity of changing the color of its blossoms. At one time the flower assumes the tint of the lily, and again shortly takes the color of the rose.

In Tibet there is a most curious tree known as the tree of the thousand images. Its leaves are covered with well defined characters of the Tibetan alphabet. It is of great age, and the only one of its kind known there.—N. Y. Herald.

TURBINE VESSEL FOR LAKE MICHIGAN.

Next summer between Chicago and Michigan resorts one of the finest vessels on fresh water anywhere, will ply the waters of Lake Michigan. The craft will be called the "Turbine Queen," and will be built this winter at a cost of $300,000.

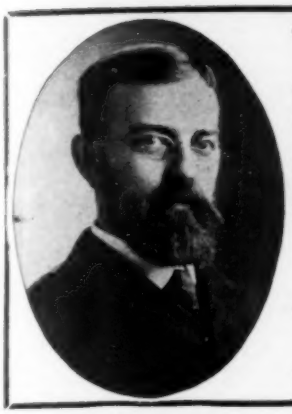
IT HELPS BUSINESS

To Have Your Office Furnished With

ANDREWS' High Grade Office Fittings
ANDREWS' Typewriter Desks
ANDREWS' Typewriter Metal Chairs
ANDREWS' Office Desk, medium to best
ANDREWS' Bookkeepers' Desks & Chairs

Our designs are the Latest and Most Artistic. SEND FOR CATALOGUE.

The A. H. Andrews Co.
174 Wabash Ave., - - Chicago



Young Man Make Money On The Side

No Experience Required
Sample Outfit Free
They cost us $25.00
Suits cost agents from $10.00 to $20.00
Agents make 33⅓ per cent or 50 per cent.

Biggest Agent has sold $5,000 since March 1, previous to which he never had a tape in his hands.

ALL GARMENTS UNION MADE. FALL SAMPLES NOW READY

JAS. F. STILES & CO.

Wholesale Tailors 293 E. Madison St., Chicago

VAST FORESTS IN HAWAII CONTROL THE WATER SUPPLY.

Fifty thousand acres of the Hawaiian forests sprang from a single algaroba tree planted in 1837 by a Catholic priest. To-day that first tree still stands, 50 feet tall and 2 feet in diameter, while near the sea level on all the islands stretch the dense forests of the younger growth, ranging from 50 to 60 feet in height, and springing up in places so arid and rugged and bare that no other growth could obtain a hold, much less flourish.

The forests thus introduced are the most valuable of any the islands produce. For fuel it sells for from $9 to $10 per cord; for fence posts it is in great demand, and when cut down it rapidly renews itself by seeds and sprouts, and a new forest from 20 to 25 feet in height takes the place of the old within four years after cutting. When three years old it bears pods which are an important stock food.

In an interesting bulletin the Bureau of Forestry tells something further of the Hawaiian forests. The native forests are a dense growth on the elevations and are of a tropical character. The lehua forms about three-fourths of the native forests and grows to a height of 30 to 100 feet; the tall ones are 4 feet in diameter with a clear length of 40 to 50 feet. Dense undergrowth forms an impenetrable forest, and this undergrowth holds so much water that a good drink may be squeezed out in a dry season. The lehua has no commercial value save for fuel.

The koa is the one tree valuable for its lumber. It is often 75 feet high and from 6 to 8 feet in diameter. The wood is in rich shades of red and brown and the grain fine and indistinct. Mamane is a tree useful to ranchmen for posts and the kukui produces an oily nut used by natives for illumination.

Stock, insects, grasses, fire and clearing have caused a great decline in these forests. For many years cattle ran wild and their slaughter was prohibited, and though many thousands have since been killed there are thousands left. These menaced the forests. Goats were even more destructive and immense numbers of deer trampled the undergrowth and rubbed the bark from young trees. Injurious insects and rank grasses followed in the wake of the stock and serious fires laid waste vast tracts.

The water supply for the sugar industry depends on these protective native forests. Farming is an unprofitable business there, and the sugar export is 96 per cent of the total exports, and other industries flourish largely because the sugar industry exists. Commercial interests will control the government's management of these forests. Vast reserves will be fenced in, and all that will promote the welfare of the greatest number will be carefully attended to.

Are You a Lover of

Good Tea and Coffee

We are making a Special Proposition to those who enjoy a beverage that is not only delicious, but more appetizing and nutritious than any other tea and coffee on the market.

THE GREAT AMERICAN TEA COMPANY

Write for **Special Christmas Proposition** to persons getting up clubs or sending orders of $5.00 and upwards.

It is worth your while, as we intend to use unheard-of efforts to increase the number of customers during the next two months.

This offer applies only to readers of Popular Mechanics

Write us at once—to-day—to

MR. CARL,

Great American Tea Co.,

31 & 33 Vesey St., P. O. Box 289, New York

BIG BRASS BAND OFFER.

We sell the celebrated IMPERIAL, DUPONT and MARCEAU Band Instruments at about one-half the prices others ask for the same high grade goods. For our **Free Band Instrument Catalogue**, also our **Free Booklet**, entitled, "How to Buy Band Instruments," for large illustrations and complete descriptions of our three large lines of brass instruments, also everything in Drums, Clarionets, Flutes, Saxophones, etc., etc., for the free catalogues, our guarantee and refund proposition, for the most liberal band instrument offer ever heard of, for the new method of selling instruments fully explained, for something new and immensely interesting to every bandman, cut this ad out and mail to us today. **SEARS, ROEBUCK & CO., CHICAGO.**

BOYS

We are giving away Base-ball outfits, Boxing Gloves, Punching Bags, Footballs, etc.

Send address for full particulars to

POPULAR MECHANICS,

602 Journal Bldg. Chicago, Ill.

Telegraphy

taught thoroughly. Institution established 1874

Endorsed by officials Railroads and W. U. Tel. Co. Positions secured. **Entire cost**, tuition (telegraphy and typewriting, board and room, **6 Mos. course, $89. Can be reduced.** Home nstruction also given. Catalogue W free.

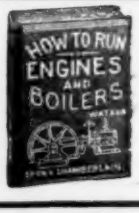
Dodge's Institute of Telegraphy, - - Valparaiso, Ind.

AGENTS Make 100 PER CENT on **Conklin's Vest Pocket Argument Settler.** Revised edition with New Census Statistics, 254 pgs. A complete Encyclopedia of a million proved Facts Tables, and General Information. It settles Arguments instantly. Invaluable to everyone. Sample postpaid, Cloth, **25c.**, Morocco, **50c.** Stamps taken. Agents wanted. **George W. Noble, Lakeside Bldg., Chicago, Ill.**

SAMPLE COPY KANSAS OIL EDITION INVESTOR'S REVIEW **FREE**

Tells all about great opportunities to make money in this new oil field. This special number is fully illustrated and contains a vast fund of valuable, interesting and reliable information; read it before you invest a dollar. Heed its advice and you will surely become a successful investor. There are hundreds of opportunities to make big money in Kansas oil. Get posted and keep posted. Do it now, not to-morrow, BUT RIGHT NOW. ASK FOR KANSAS OIL EDITION, Just Out. Address,

INVESTOR'S REVIEW, 1461 Gaff Building, - - - - CHICAGO, ILLINOIS.



7,000 COPIES SOLD

THE BEST BOOK to HELP YOU MAKE **MORE WAGES**

Written in plain language and fully illustrated.

Spon & Chamberlan Dept. P. M. Liberty Bldg., New York **FREE for $1.00**

INDUSTRY MAGAZINE for August contains "How I Got My Automobile and Made It Pay for Itself." YOU can do likewise. How to make an Electric Telephone for fifty cents. A Valveless Gasoline Engine for automobile, boat or power, illustrated. A miniature Water Power Electric Plant. Electrical Firecrackers, and many other valuable articles, formulas, hints and helps for Mechanics, Amateurs, Students, Teachers and Business Men. Every number full of helpful PRACTICAL information. How to make Electrical Machinery and Apparatus, Gas and Steam Engines, Boats, Launches, Traps, Camps, etc. We furnish complete working drawings and instructions. Also articles on Mining, Technology, Manufacturing, etc. Fifty cents per year.

Three months' trial, 10 cents. SPECIAL OFFER to new subscribers—For fifty cents, Industry Magazine 17 months and a 64-page illustrated book on toy and model making worth the whole price. See our $500 "Hit or Miss" Prize offer in July number. You can enter this contest, open to every subscriber. Send your subscription at once. **INDUSTRY MAGAZINE,** Box P. M., Fairfield, Maine.

Where Can You Beat This?

An electric motor with wrought iron field magnet, 2" armature, pulley, entirely new design for 65 cents, postpaid. Induction coils, novelties, supplies, etc.

Catalog Free.

Artesian Electric Co. 1059 Columbia St. Chicago

WHERE JOHNNIE IS.

Ever since John went away
She would hold to this old map,
"Findin' Johnnie," day by day,
With it spread out in her lap.
Who was John? He was our boy—
Soldier boy—so full of fun;
Never cared to have a toy,
'Cept a sword, or drum, or gun.

So, when he was gone, I say,
Mother, she would sit and chat
With the map spread out this way
And the flag pinned "where John's at."
Nights, when I would lock the door
And go to put out the light,
She'd say: "Let me look once more
To find where John sleeps to-night."

By and by she seemed to fail—
Couldn't think what it might be
But her cheeks grew waxen pale
Where the roses use' to be.
But she never suffered so
That she couldn't find "John's place"—
And her eyes—how they would glow
When his marches she would trace!

Then, one day, the telegraph
Came that our boy John was—dead!
I can never tell you half
What I thought when that I read.
Mebbe it was wrong to do,
But to mother—Well, I lied;
Told her John was almost through
With the war, and then she cried.

Late one night I heard her say:
"Bring the map. I want to see
Where our Johnnie was to-day."
Then she looked straight at me
And picked up the map like this—
But her eyes looked on, and on,
And she cried out: "There he is!"
Then dropped back and whispered "John!"

This old map—I keep it here,
Smudged and tattered up this way.
And that blot? That is a tear
Markin' where John was one day.
That is where our Johnnie fell,
Fightin' with those men of his.
Mother knows—I couldn't tell.
Mother—she's "where Johnnie is."

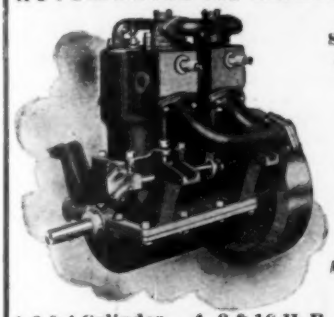
—Chicago Tribune.

NEW METHOD OF TESTING EGGS.

A new and simple method of testing eggs is now being used in Germany and is calculated to make the egg-candler's work much more speedy and accurate, writes U. S. Consul-General Guenther at Frankfort, Germany.

The air chamber in the flat end of an egg increases with age. When a fresh egg is placed in a saturated solution of common salt it lies in a horizontal position at the bottom of the vessel. When it is three or four days old the flat end is elevated so that the long axis forms a 20-degree angle with the bottom of the vessel. The older the egg the greater the angle. At three weeks it is 75 degrees, and at a month the egg stands vertical. By attaching a scale to the vessel it is possible to determine the age of the egg almost to a day.

AUTOMOBILE AND MARINE MOTORS



SIMPLE, COMPACT and POWERFUL

Best material.
Perfect workmanship.
Send for Catalog.

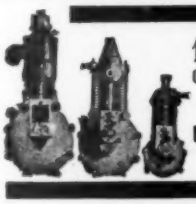
ALEXANDER & CROUCH,
71 W. Monroe St.,
Chicago

1, 2 & 4 Cylinder 4, 8 & 16 H. P.

A MOTOR-CYCLE AT SMALL COST

By using one of our Attachable Outfits. THOROUGHLY PRACTICAL. In USE FOUR YEARS. Also a complete line of Motors, Castings and Accessories for Bicycle, Automobile Marine or Stationary.
Send stamp for Catalogue.

STEFFEY MFG. CO.
Brown and Pennock Sts., Philadelphia, Pa.



1¾ H. P. Bike Motor, $7.50
CASTINGS WITH DRAWINGS, Latest Model
We also have them in 2 1-2 H. P.

For fuller information address
Eureka Mfg. & Supply Company,
St. Paul, Minnesota

AUTOMOBILE PARTS

OF EVERY DESCRIPTION.
Write for Catalog and Prices.
OTTO KONIGSLOW,
CLEVELAND, OHIO

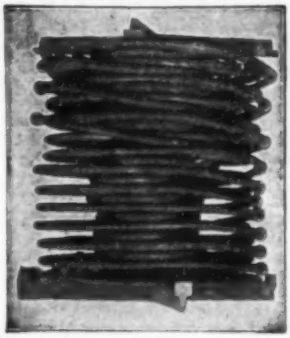
SPROCKETS
and EQUALIZING GEARS
IN STOCK OR TO ORDER.
Standard makes of Chain on hand.
Prompt delivery....Catalogue free.
CULLMAN WHEEL CO., 522 Larrabee St., Chicago

ECLIPSE POCKET AMMETER
For General Battery Testing. 0 to 20 Amperes
Flexible cord attached and contact spur in case, which is DRAWN BACK INTO CASE, when carried in pocket. Size of watch and very light weight.. Can be used in any position. Particularly designed for Auto use.
PRICE $5.00
ELDREDGE ELECTRIC MFG. CO.
227 Main Street, Springfield, Mass

DRAWING STUDENTS NEED THE DRAFTSMAN
25c for 4 months—Cleveland, Ohio

WE CAN KILL THOSE
IGNITION TROUBLES
DURO BATTERIES ARE THE MOST DURABLE, COMPACT and EFFICIENT
The Only Way of Obtaining a Mileage Guarantee
Chicago Battery Co.
1421 Michigan Avenue, Chicago

Our New FLASH BOILER
For 1904



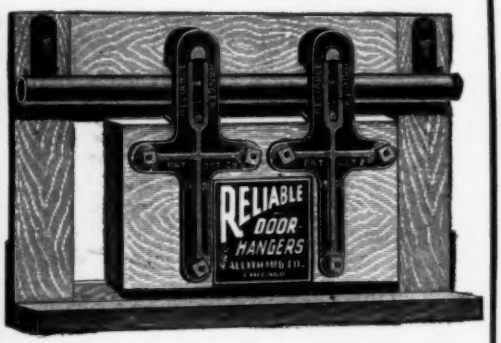
No burning of boiler—No water gas—No smoke
Absolutely Non-explosive.
OUR PERFECT **KEROSENE BURNERS**
Condensers, and other appliances are marvels of mechanical development.

Barton Boiler Company
SOLE MANUFACTURERS,
4230 State St., Chicago, Ill., U. S. A.

Write for full particulars

KEROSENE OIL ENGINE
Stationary, Marine, Portable. Send for catalog
Int'l Power Vehicle Co., 381 Dearborn St., Chicago

THE "RELIABLE ROUND TRACK
DOOR HANGER"



You knew how the old-fashioned Door-Hanger sticks
Ours Will Not Bind
Ours Cannot be Derailed

Let Us Tell You About It

WRITE FOR CATALOG AND PRICES

ALLITH MANUFACTURING CO.
120 South Green Street, Chicago

SEE SPECIAL OFFER
ELSEWHERE OF OUR NEW BOOK
"Popular Mechanics Shop Notes"
JUST OUT

WE BUILD GASOLINE ENGINES
Automobile, Marine and Stationary
Transmission, Gears, Carburetters, Pumps, Mufflers, &c.
Write for circular and prices before ordering
W. B. MURRAY, 1253 Milwaukee Avenue, Chicago

EVERY FALL
We Issue a BARGAIN Sheet Just To Get Rid of Our Goods.
AUTOMOBILE THINGS YOU NEED.
WE NEED THE MONEY.
WRITE AWAY; RITE FOR IT.
The MOTOR CAR SUPPLY CO.
1427 Michigan Ave., Chicago
IT - IS - UP - TO - YOU

BEES CAME DOWN THE CHIMNEY.

A Minnesota man had a most unusual experience with a swarm of bees not long since. His family was away from home and when he entered the house in the evening a peculiar sound that seemed to come from everywhere at once greeted his ears. It did not take the gentleman long to find out that the house was completely filled with bees. They had come down the chimney, and through the fireplace and were buzzing angrily about, not yet decided on settling down. The Winona Republican and Herald gives a graphic account of what followed:

Their greeting was warm, but not what could be called cordial. Mr. Casey rushed upstairs, shooing the insects off as he ran, threw a pillow case over his head, tied strings around the bottoms of his pant's legs, and put on some old baseball gloves. Not knowing much about the bees, he tried building small fires in the different rooms,using his wife's best kitchen-ware for fireplaces. But the bees wouldn't be smoked out. They seemed to like it.

They were by this time getting in their work on his protective armor, and in mortal terror lest they find a vital spot and put him out of action, the quondam head of the house fled precipitately. A man down town told him to get a bee fancier who could hive the bees for him. The man without a home hunted up the bee expert.

"About seven million bees have taken possession of my house; came down the chimney," he began.

"Lucky for you," replied the entomologist enthusiastically. "They're worth $15."

"Not till they're dehorned; no, not to little Will," replied the amateur apiarist decidedly. "What I want is a bee cowboy that can round 'em up and lasso 'em; they've got to be caught, corralled, drowned, smoked out, decapitated, or some old thing before I can go home. Might have known something 'd go wrong when my wife left town."

"You wan't 'em hived do you?" demanded the apiarian.

"I don't know whether that's what I want or not," replied the discomfited householder. "I want 'em ejected, thrown out, ordered off; and then I want a plank nailed over the top of the chimney. Say, suppose they make honey all over the floor and fill the grate with it?"

The beeman smiled.

"Do I get the bees if I get 'em out?"

"You bet you do; you'll get good and plenty of 'em too, if they're feeling as ugly as they did when I left 'em. You can have 'em if you'll agree to take 'em away far enough so they won't know the way back."

And so it was done. The beeman took a hive, set it up in the Casey parlor, made a few passes at the queen bee, and lugged off a $15 tribe of honeymakers. Mr. Casey didn't even regret their going, but he looked under the bed before he retired that night.

HOW SEA BIRDS DRINK.

"When I was a cabin boy," said an elderly sailor, "I often used to wonder, seein' birds thousands of miles out to sea, what they done for fresh water when they got thirsty. One day a squall answered that question for me. It was a hot and glitterin' day in the tropics, and in the clear sky overhead a black rain cloud appeared all of a sudden. Then out of the empty space, over a hundred sea birds came dartin' from every direction. They got under the rain cloud and they waited there for about ten minutes, circlin' round and round, and when the rain began to fall, they drank their fill. In the tropics, where the great sea birds sail thousands of miles away from shore, they get their drinkin' water in that way. They smell out a storm a long way off; they travel a hundred miles, maybe, to get under it, and they swaller enough rain drops to keep them goin'."—Portland Oregonian.

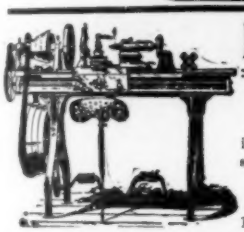
Novelties Made to Order

we'll show you how to place your invention on the market and make money.

Metal Stamping
We make Dies and Tools that will turn work out cheaply. Write us—

CHICAGO RIFLE MANUFACTURING CO., 11-21 SO. JEFFERSON ST., CHICAGO

CRANE VALVES
ESTABLISHED 1855



LATHES
9 to 13 inch Swing

List price, $65.00 and up according to size. When ready to buy send for Lathe Catalog and prices

W. F. & John Barnes Co.
100 Ruby St., : : Rockford, Ill.

POPULAR MECHANICS
Cen give you the address of the maker of any
MACHINE OR TOOL

FOOT and POWER
AND TURRET LATHES, PLANERS SHAPERS AND DRILL PRESSES ::::

SHEPARD LATHE CO.
A131 W. 2d St., Cincinnati, Ohio

AUTOMATIC —PIPE— WRENCH

Strongest
Simplest
Best

It is self-adjusting and self-releasing. It never gains. Made in three sizes, 10-inch, $2.00; 16-inch, $2.75; 24-inch, $5.00, express prepaid.

H. P. VAN NESS
607 Northern Office Bldg., CHICAGO, ILL.

If you want anything and don't know where to get it write us.
If you have a new idea or invention ask our Patent Bureau what you want to know and they will answer promptly and fully without charge.
We want a mechanic in every shop to act as our agent. Write for particulars.
POPULAR MECHANICS CO.

"STAR" FOOT AND POWER LATHES

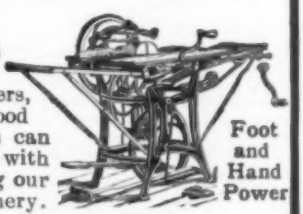
Are used extensively by repair shops, tool-makers, gun-smiths, experimental and model makers, etc.

Built for durable and fine accurate service, containing throughout the highest type of modern construction. 9 to 14 inch Swing

SEND FOR CATALOG "B."

Wood Working Machinery

COMPLETE OUTFITS



Foot and Hand Power

Carpenters, builders, cabinet-makers, wood workers and others can successfully compete with large shops by using our labor-saving machinery.

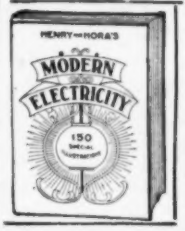
SEND FOR CATALOG "A."

THE SENECA FALLS MFG. CO.
103 WATER STREET, SENECA FALLS, N.Y., U.S.A. Adv. No. 44.

Greatest Electrical Book

Modern Electricity

By HENRY & HORA



Is full of information invaluable to you if you are interested even remotely in this great science. It is a new and most complete encyclopedia containing full descriptions of electrical devices and machinery, systems of transmission and distribution—treating most minutely every important branch, including X-Rays, wireless telegraphy, radium, power stations, wiring, etc. In compiling this book the authors have studiously avoided theories and technical phrases which discourage the efforts of the average reader. Modern Electricity is written in that plain good English so desirable to everyone and appreciated as well by experts. 355 pages, Cross index.

THE PROBLEMS OF ELECTRICITY SOLVED

A boon companion for the electrical engineer, workman, apprentice or student.

PRACTICAL : ACCURATE : SCIENTIFIC

But above all simple
Absolutely original matter prepared by expert electrical engineers, never published before.

150 ILLUSTRATIONS

drawn especially for this work.

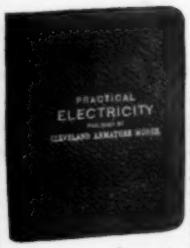
Silk Cloth Decorative Cover, Silver Stamping, : : : $1.00
Seal Leather, Marbled Edges, Gold Stamping, : : : : 1.50

Laird & Lee's Imprint on Scientific and Mechanical Books Guarantees Reliability.

AT YOUR DEALER'S OR
SENT POSTPAID ON RECEIPT OF PRICE.

LAIRD & LEE, PUBLISHERS, 263-5 Wabash Av. **CHICAGO**

A School Within Itself



Space will not permit our telling you all about this book, but better still, we give you a chance to examine it for yourself by our offer to refund money if book is not satisfactory upon examination. Under this offer, 11,000 copies have been sold and paid for, and out of this number we have refunded for only fifteen copies. There are nineteen chapters, carrying you from the fundamental principles of electricity through the art to the finished dynamo. Contains a dictionary defining 1,500 words.

3rd Edition. Price, $2.00 delivered.

CLEVELAND ARMATURE WORKS, Cleveland, Ohio

FREE Catalogue of Architectural, Scientific and Technical Books —Prospectus for 1904, for Architects and Builders' Magazine" monthly.

$2.00 a Year

WM. T. COMSTOCK, Publisher, 23 Warren St., N. Y.

TELEGRAPHY

Telegraphers' Penmanship and Typewriting

COMBINED IN ONE TUITION

We are unable to meet the demands of the railroads for our graduates. Positions guaranteed to all our students. Send for catalog.

The Chicago Railway & Commercial Institute
97 Washington St., Chicago, Ill.

HOW SHALL THE INVENTOR INTRODUCE HIS INVENTION?

To the Editor:—After an inventor has secured his patent, say, for some small article for domestic use, what is the next step for him to take in order to introduce it to the public, and at the same time get some slight returns out of its sale for himself?

G. E., Paterson, N. J.

In reply to your request for information as to the best way for an inventor to introduce his invention into public use, we submit the following:

If you are so situated that you can economically manufacture the invention and place it on the market yourself you should do so, at least until you have established a demand for the article among the trade. You should first have some samples made up in the best style possible and take them to the retail trade, selling outright if possible at a small margin, or, if necessary, placing the goods on commission. At the same time you should advertise the goods as effectively as possible, and to do this it is usually economy to consult a professional advertising expert, as advertising is a business that requires expert knowledge as much as any other business. If the goods sell well then take up the matter with jobbers and try to sell to them. If the jobbers refuse to handle the article, continue to offer it to the retail trade until a demand is thoroughly established, when you will have no difficulty in securing customers among the jobbers. If the returns justify giving the matter your exclusive time and attention, or the organization of a company to take it over, the question of manufacturing the article as cheaply as possible should be carefully investigated with a view of making it a permanent business. If, however, the sales are limited and there seems to be no prospect of increasing them materially because of lack of means or selling ability, the best plan is to turn the article over to some manufacturer making similar articles and receive a royalty.

If you are not in position to manufacture and introduce the article in the manner above mentioned, your best recourse is to take the device in the first place to a manufacturer of similar articles and have it made and sold on a royalty. To grant a license for the manufacture of an invention in consideration of a fair royalty will usually bring the greatest returns to the inventor—returns exactly in proportion to the invention—provided the article is made and sold by the manufacturer having the best facilities for making and selling it; that is, the manufacturer who is so equipped as to be able to produce the article at the least possible cost, and whose facilities for selling that particular device are unsurpassed. Such a combination means that the article will be sold in the very largest quantities; and the manufacturer's fitness for handling it will keep imitators out of the field. Care should be exercised in making contracts under royalty conditions to see that the inventor's rights are fully protected. It is a fact that few inventors have the business ability to handle commercially their inventions. They need the assistance of business men and usually those who have had experience in introducing new articles to the public. A peculiar ability is required to insure success in this line and it is usually economy to secure the services of one having such ability.

Always perfect your samples before submitting them to manufacturer or dealer. Submit your samples to several manufacturers and make a deal with the one who is rated best by Bradstreet's, is best equipped to sell your article and who will give you

THE American School of Correspondence offers every man who wants to learn something about ENGINEERING an opportunity to do so NOW at unusually favorable terms.

Write for our FOUR GREAT SPECIAL OFFERS (not in force after November 1) regarding our courses in

ENGINEERING

TAUGHT BY MAIL

Electrical Engineering
Central Station Work.
Electric Lighting.
Telephone Practice.
The Electric Telegraph.
Electric Wiring.

Mechanical Engineering
Sheet Metal Pattern Drafting.
Shop Practice.
Boiler Makers' Course.
Tool Makers' Course.
Sheet Metal Work.
Metal Roofing.
Cornice Work.
Tinsmithing.

Stationary Engineering
Marine Engineering.
Locomotive Engineering.
Boilers and Engines.
Special Refrigeration.
Engineers' Course.
Firemen's Course.

Civil Engineering
Municipal Engineering.
Structural Engineering.
Railroad Engineering.
Surveying.
Hydraulics.
Structural Drafting.

Sanitary Engineering
Heating, Ventilating and Plumbing.
Heating and Ventilation.
Plumbing and Gasfitting.

Architecture
Architectural Engineering.
Contractors and Builders.
Architectural Drawing.
Carpenters' Course.

Textile Manufacturing
Complete Cotton.
Complete Woolen and Worsted.
Complete Knitting.
Cotton Spinning.
Woolen and Worsted Spinning.
Warp Preparation and Weaving.
Textile Design.
Textile Chemistry and Dyeing.

Mechanical Drawing
Perspective Drawing
College Preparatory
Complete Preparatory.
Special Mathematics.
Sp. Mech. Drawing

200-Page Bulletin and full information regarding any particular course free on request.

NOW IS THE TIME if you are thinking of studying this winter. Get to work early and you will be earning more money by Christmas.

The attached coupon has money value for you. Cut it off and mail it to us TODAY.

CUT OFF ALONG THIS LINE

AMERICAN SCHOOL OF CORRESPONDENCE
at
Armour Institute of Technology, Chicago.

Please send me full information regarding your four special offers regarding your ..... course.

Name .....

Address .....

City ..... State .....

Pop. Mech. Oct.

PATENTS Valuable and Salable Patents Secured. Advice as to Patentability and Commercial Value Free

SHEPHERD & PARKER, PATENT LAWYERS

"During the past 10 years Mr. Shepherd, of Shepherd & Parker, has obtained for us a great many important patents. We have no hesitation in heartily recommending him to anyone having need of the services of a patent attorney.
HALLWOOD CASH REGISTER CO.

Mr. Parker on Nov. 1, 1903, resigned his position as an examiner in the U. S. Patent Office to enter this firm. Address
210 Revenue Building • • WASHINGTON, D. C.

What Is Daus' Tip-Top?

TO PROVE that Daus' "Tip-Top" is the best and simplest device for making **100 copies** from pen-written and **50 copies** from typewritten original, we will ship complete duplicator, cap size, **without deposit,** on **ten (10) days' trial.**
Price $7.50 less trade discount of 33⅓%, or **$5 net**
THE FELIX F. DAUS DUPLICATOR CO.
Daus Building, 111 John St., New York City.

THE WINGET **CONCRETE BUILDING BLOCK MACHINE**

Automatic Adjustable
Makes any size or shape block required in ordinary building operations
Straight & Corner Block
A. D. MACKAY & CO., Chamber of Commerce, CHICAGO, ILL.

LOW PLUMBING BILLS
Get them by paying right prices for supplies. We sell
SUPPLIES AT WHOLESALE
You save 20% to 40% on every article. Highest grade goods and line complete. Free illustrated catalog gives all particulars. Write for it.

B. P. KAROL,
220 W. Harrison St., Chicago.

METAL BREAD BOARD
Reversible—No wood about it. Hygienic, sanitary, low-priced. Cannot crack, split nor warp. Lasts Forever. Every woman wants one. Sample postpaid 25c
Agents Wanted.
LYONS MFG. CO.,
15 Day St., PEKIN, ILL.

MAGIC
I will teach you one new coin trick and one new card trick for 20 cts. or either for 10 cts. I will send *"Book of Card or Coin Tricks,"* 180 p., 25c. each, and include illus. catalog of 240 tricks free with order. Learn at home, amaze your friends, mystify, startle and entertain. ROBERT WASSMANN, Instructor in Magic, 227-E Webster Ave., CHICAGO, ILLINOIS.

ELECTRIC MOTOR
The Rienco Motor runs at high speed when connected to one cell of almost any kind of battery. It rotates in either direction and is reversed without changing connections. It is fitted with grooved pulley. Price, 50 cents. Postage and packing, 15 cents
Motor Outfit No. 8
consists of 1 Rienco Motor; 1 Rheostat, or speed regulator; 2 Small Dry Batteries and 10 feet of wire. Price, $1.00. Postage and packing, 30 cents. Send stamp for catalog.
Ithaca Electric Nov. Co., Inc. Box 64, Ithaca, N. Y.

Send for
POPULAR MECHANICS
PREMIUM LIST
Just Out

the fairest contract. Never make a contract without first submitting it to your attorney. This is the rock on which most inventors founder. Don't part with the title to your patent until the money has been paid or its equivalent contracted for.

These are a few of the things to do and not to do. Individual cases require special treatment, and what has been said applies only to the average state of facts.

HINTS TO INVENTORS.

The trouble that farmers have had this summer in trying to get harvest hands would be simplified to some extent if somebody would invent a new implement for the hay field, says the Implement Age. There ought to be some way for the farmer to get his hay from the swath into the barn without the help of hired men, who are so hard to find. The manufacturers of hay-making implements may say that this is impossible, and that the implements they now furnish are the best that human ingenuity can produce, but American inventors are always doing impossible things.

The hay harvest is the sticking point in the American system of agriculture. With the exception of haying time, a farmer, on an average, diversified farm, can do all his field work without hiring help, from the first furrow of spring to the last wagon load of corn in the fall. One man can harvest an average field of wheat or oats, of the size that we find east of the Mississippi, by running a binder in the morning and leaving the team in the stable while he shocks in the afternoon. And in the same way the farmer could mow his grass and shake it up with a tedder in the forenoon, and in a week of haying season he could take care of the hay crop of the average farm, if there were only some way in which one man could go it alone in hauling the crop to the barn in the afternoon, so as to take care of what he can mow and ted in the morning.

The hay loader has proved a valuable implement to the busy farmer, especially on large stock farms. One loader will keep two or more wagons going in hauling to the barn, if there are enough men to take care of their part of the work. The average farmer, however, only raises 20 to 30 acres of hay, and he likes to be independent of hired help and his neighbors, and he would not need any help in taking care of his hay crop if some ingenious inventor would kindly give him the right kind of help in the afternoon.

STRANGE PET OF A BORNEO WOMAN.

The wife of the governor of North Borneo has a pet which few women will envy her. The governor's house is near a jungle, and from it strayed a baby rhinoceros. Captured as a curiosity, he at once became tame and refused to return to his native wilds. He consumes sixteen quarts of milk a day, and on this diet thrives and grows fat. He might be mistaken for a queer sort of hog were it not for the horn in the middle of his face. He is devoted to his mistress and follows her about like a dog.—London Standard.

PATENTS

Counselor in Patent Cases, Solicitor of Patents. Opinions furnished as to the scope and validity of Patents.
428-29 Woolner Building, - - -
Chas. W. LaPorte
PEORIA, ILLINOIS

WE CAN MANUFACTURE ANYTHING IN

Brass, Aluminum, Phosphor-Bronze or Gun Metal

We also manufacture Refrigerators, Beer Pumps, Faucets and Supplies.
Our Prices are reasonable. Write us.

U. S. SPECIALTY MFG. CO., - 33 Washington St., Chicago

SPECIAL MANUFACTURING

Dies and Stamping

--TO ORDER--

SPECIAL MACHINERY, MODELS
EXPERIMENTAL WORK

DROP FORGING DIES AND DROP FORGINGS

Hardware Specialties, etc., Manf'd to Order. Send Samples or Drawings for Estimates. Write for Our Booklet.

THE GLOBE MACHINE & STAMPING CO.
973 Hamilton St., - Cleveland, Ohio

I SELL
PATENTS

on hardware or mail-order specialties, machinery, anything. If you wish to buy or lease them on royalty write me.

INVENTORS

desirous of selling their patents quickly and to the best advantage should register with me. I ave you time and money.

CHAS. A. SCOTT
796 Mutual Life Building
BUFFALO, New York

NAME PLATES, TRADE MARKS

THE MEYERCORD CO.
DECALCOMANIA TRANSFERS,
NAME PLATES, TRADE MARKS AND ORNAMENTS
OPALESCENT TRANSFER WINDOW SIGNS

TRANSFER WINDOW SIGNS

HARDWARE AND METAL SPECIALTIES
Manufactured on Contract

PUNCHES AND DIES
SPECIAL TOOLS
GEAR CUTTING

CRAIG MANUFACTURING CO.
39-43 West Washington St., Chicago, Ill.

MODELS AND SUPPLIES

Send for Illustrated Catalog of Appliance for Models

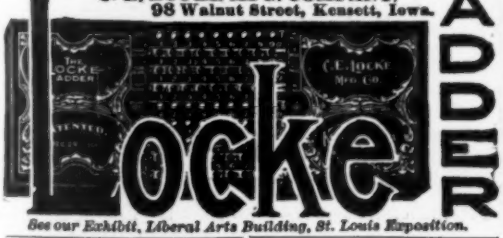
J. WEINERT & CO., 134 Pierce Avenue, Chicago

J. W. Middleton & Co.
PUBLISHERS OF
THE INTER-STATE CORPORATION RECORD
Containing all Forms and Blanks for Organizing a New Corporation Stock Certificates, Bonds, Corporate and Notarial Seals, Blank Books, Printing, Lithographing
165-167 Dearborn St. Chicago

THE MODERN ADDING MACHINE

If you knew that you could get one for $5.00 that would give results as quickly and accurately as a $375.00 machine, wouldn't you get it? The Locke Adder will do this and more. It adds, subtracts, multiplies and divides. Computes nine columns at once. *Cannot* make mistakes. Capacity, 999,999,999. Size, 4x10½ inches. **Price, $5.00,** prepaid in U. S. Write for FREE booklet. AGENTS WANTED.

C. E. LOCKE MFG. COMPANY,
98 Walnut Street, Kensett, Iowa.



See our Exhibit, Liberal Arts Building, St. Louis Exposition.

MODELS

CHICAGO MODEL WORKS
175-181 E. MADISON ST., CHICAGO, ILL.
WRITE FOR CATALOGUE OF MODEL SUPPLIES

ESTABLISHED 1867

IDEAS PATENTED

May Bring a Fortune.

Fee refunded if unsuccessful. Write for free Booklet on Inventions. Send rough sketch for free report as to patentability. Patents obtained by me advertised free in Chicago papers.

JOHN L. KINDT
Patent Attorney, 31 Randolph Street, CHICAGO

TYPEWRITERS ALL MAKES

All the Standard Machines Sold or Rented Anywhere at Half Manufacturers Prices. Shipped with privilege of examination. Send for cata'g
Typewriter Emporium, 190 La Salle St., Chicago

Rabbi Hirsch of Chicago was riding in a crowded street car and rose to surrender his seat to a lady. Before she could take it a young man plumped himself into it. The rabbi looked at him in disgusted silence. "What's the matter?" demanded the man. "What yeh glarin' at me for? Yeh look as if yeh'd like to eat me." "I am forbidden to eat you," answered the rabbi. "I am a Jew."

Take the

Grand Canyon

Home with you!

A Souvenir of Earth's Greatest Wonder in the form of book or picture will keep its beauties constantly before you. For fifty cents we will send the season's novelty, a handsomely colored view of the Canyon, uniquely mounted to reproduce its marvelous tints. Or, for same price, a Grand Canyon book of 128 pages, 93 fine illustrations, cover in colors; articles by many noted authors and travelers. Worthy a place in any library. Address Geo. T. Nicholson, 1312 Great Northern Building, Chicago.

The Overland Limited

California

the most luxurious train in the world, leaves Chicago 8:00 p. m. daily. Less than three days to San Francisco. Magnificent equipment. Electric lighted throughout.

THE BEST of EVERYTHING

Two other fast trains leave Chicago 10 a.m. and 11:35 p. m. daily, with through service to San Francisco, Los Angeles and Portland via the

Chicago & North-Western, Union Pacific and Southern Pacific Railways

All agents sell tickets via this route. Illustrated booklets on application to W. B. KNISKERN, CHICAGO, ILL. or E. L. LOMAX, OMAHA, NEB.

OL16

The New

Popular Mechanics

PREMIUM LIST

Fully Illustrated
Is Now Ready

BOOKS FOR MECHANICS,
ELECTRICIANS, ENGINEERS
SHOP TOOLS OF ALL KINDS
SPORTING GOODS, WATCHES, ETC.

Something for everybody given for one or more new subscribers.

ADDRESS

Popular Mechanics
JOURNAL BUILDING, CHICAGO

INDUSTRIES

ARE

OFFERED LOCATIONS

WITH

Satisfactory Inducements
Favorable Freight Rates
Good Labor Conditions
Healthful Communities

ON THE LINES OF

THE ILLINOIS CENTRAL R. R.

AND THE

YAZOO & MISSISSIPPI VALLEY R. R.

For full information and descriptive pamphlet, address

J. C. CLAIR
Industrial Commissioner
1 Park Row, - - - Chicago, Ill.